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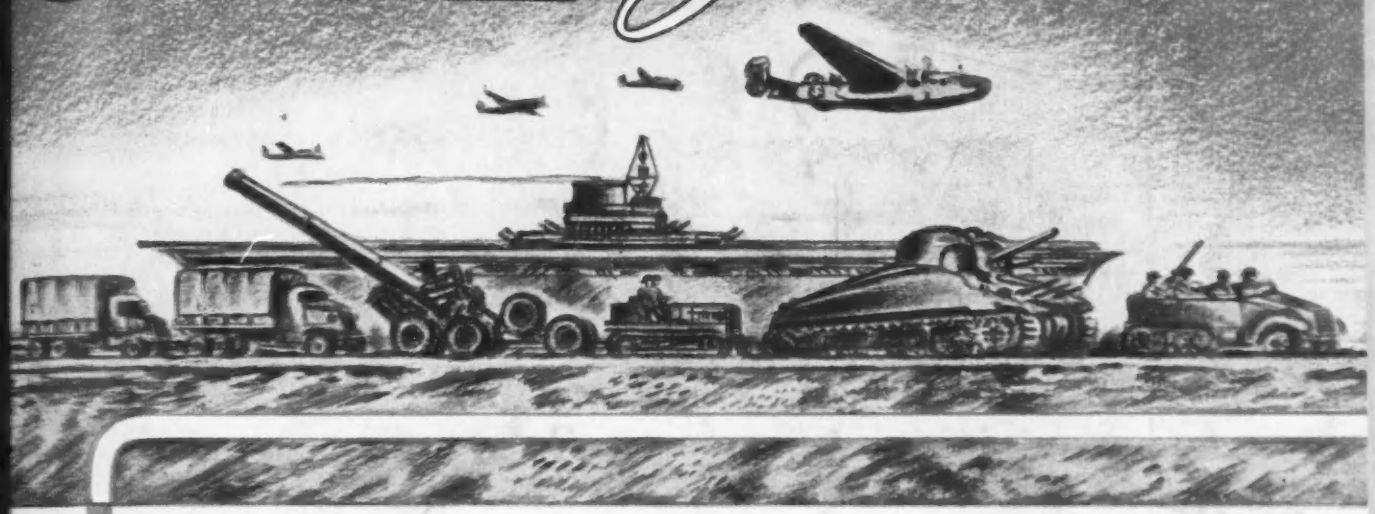

DECEMBER 1944

Intercooling Problem in Airplane Design —Holley B. Dickinson

Preparation and Preservation of Vehicles and Parts for Storage and Shipment —C. E. Heussner and C. O. Durbin

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Trends in Airplane Ice-Prevention Technique —Lewis A. Rodert

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Wartime Developments in the Heat Treatment of Steel —H. W. McQuaid

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Relation of Intake-Charge Cooling to Engine Performance —E. A. Droegemueller, D. S. Hersey, and W. A. Kuhrt

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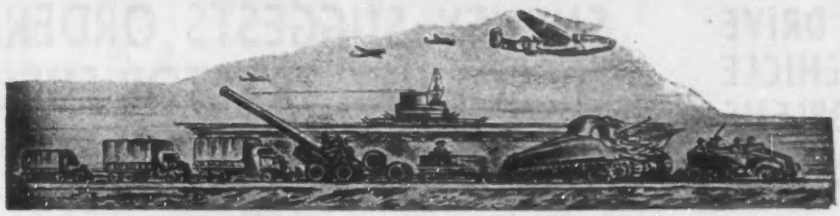

News of the JANUARY *Issue*

By Norman G. Shidle

Minds & Meetings

ATTENDING a meeting *profitably* is the hardest kind of work; calls for a variety of skills; pays good dividends to the successful. The mind must go along with the body.

Every experienced meeting-attender has his own ideas on how to get the most out of the event. Here are a few from an observer's handbook.

Seek new contacts, unfamiliar ideas. A convention is a place where people come together for a purpose. Shun the people and you miss the purpose. To return empty-minded from a technical meeting is just as wasteful as to return empty-handed from a sales trip.

Neither pure extroverts nor pure introverts get the most out of technical meetings. One talks so much he doesn't hear much except the sound of his own voice. The other keeps to himself and hears nothing he couldn't read in the trade papers next week.

Listening closely to speakers is a small part of profit-taking from meetings. You must be trying, as well, to analyze, to poke holes in the statements; to translate the ideas into terms of your own problems.

Alert listening breeds questions, stimulates additional ideas. In discussion, ask those questions; express those ideas. A good session should be a sort of intellectual Hellzapoppin'.

Make yourself available for committee activity. Either technical or administrative work often associates you with leaders in your field; makes you more important to your company; gives invaluable experience in getting results through group cooperation.

When you get back home, finish your convention-attending job. If your boss wasn't smart enough to ask for a memorandum about the meeting, write one anyhow. Fill it with facts, but point the meaning of each fact in relation to your company and your job.

Then you are through attending that meeting . . . and you will be glad of it!

Plane's Structural Continuity Applicable to Ground Vehicles?

INTERESTING byproduct of aeronautical engineering progress is the increasing attention currently being devoted to the cost of transporting a pound of weight.

The critical economic and engineering requirements of air transport undoubtedly have highlighted the problem, which has hitch-hiked on ground vehicles for years. Furthermore, the problem rapidly is transcending merely academic consideration, if only because of its ubiquitous application to all transport vehicles, from wheelbarrows to airplanes.

Various estimates of the cost mathematically are intriguing, but less pertinent than the basic fact that one pound of structural over-weight is one pound of payload lost for the operating life of a vehicle. This may be a matter of small moment in the case of a wheelbarrow, but if a transport plane loses one pound of payload throughout its operating life of millions of miles, the cost assumes the threatening proportions of economic liability.

Sharpening transportation economics seem to be demanding careful consideration of just what proportion of the gross weight of a transport vehicle represents actual payload. Timely article introducing new and interesting engineering and economic facets of the subject will appear in January *SAE Journal* as the work of Mac Short, of Lockheed Aircraft Corp.

Mr. Short's novel approach will be that of considering the possibilities of applying to ground vehicles, such as trucks and buses, the engineering thought processes which underly the design and construction of air transport planes. However divergent these engineering fields at first thought may appear to be, Mr. Short will report that each is confronted by the problem of providing just enough vehicle to carry a profitable payload and of avoiding structural excesses which not only reduce payload profits but waste fuel and energy.

Mr. Short will suggest that the adaptation of aircraft type structures to ground vehicles depends as much upon the urge, and upon engineering ingenuity, as it does upon having ideal forms and materials. He will point out the advantages of the plane's continuity of structure in solving some of the problems of truck and bus design, construction, and even operation.

The long-distance motor bus will be recommended as the ground vehicle presently most receptive to aircraft techniques, but there will be also a number of suggestions for the possible improvement of motor-truck design. Mr. Short will foresee no overnight rush to revise engineering thinking along these lines, but will advance the idea that the art of airframe construction might serve the truck and bus engineer as an inspiration, if not as a design tool.

RUBBER SHORTAGE IS MAKING TIRE CARE MANDATORY

WAR and the resulting rubber shortage are combining to establish the necessity for operators of commercial motor vehicles to become acutely tire-conscious, and is making tire care mandatory. To a degree, synthetic rubber tires are relieving the situation, but not the need for extra care.

J. E. Hale, of The Firestone Tire & Rubber Co., will explain in January *SAE Journal* full details of what must be done. His recommendations for getting maximum service from the few synthetic tires available briefly will be:

- Keep vehicle loads below maximum tire-load limits.
- Avoid high sustained speeds.
- Check tire pressures regularly.
- Avoid over-inflation.
- Retread before wear is excessive.
- Employ an experienced tire specialist for fleet operations.

HYDRAULIC DRIVE CHANGES VEHICLE TORQUE PROBLEMS

BASIC automotive problem is the conversion of torque, or transformation of the power produced by an engine into the force which turns the wheels of a vehicle.

Simple solution is gearing, which is exactly the solution applied these many years. However, gearing creates new and additional problems, among them smoothness of operation, resistance to wear, and, naturally, ultimate performance of the vehicle.

For close to four decades automotive engineers have been toying with the idea of the hydraulic drive. Mechanically, it is a simple device. Practically, its application to the motor vehicle is complicated.

The hydraulic drive is invented and designed and engineered, and now is being used in some vehicles. It works, but to make the vehicle perform as effectively as the hydraulic drive is something else again. Furthermore, while gearing takes plenty of designing and engineering, the hydraulic drive demands even more. Apparently it eliminates gears, clutch, some wear, much noise, and other troubles only to develop peculiarities of its own.

January *SAE Journal* will present an article by Albert H. Deimel, of Spicer Mfg. Corp., reviewing hydraulic drive developments. Mr. Deimel, will explain how the device works in theory, and will describe some of the engineering Alps which must be scaled before the working of the device in practice becomes fully satisfactory.

■

Century-Old Process Of Pressure Casting Serving Modern Need

MAKING unmachinable alloys into working parts directly from the casting mold is one of the many time-saving, quality-improving methods promised for post-war.

Pressure, or centrifugal, casting apparently is at least a century old, but has come along rapidly in recent years. Already it has progressed through heavy gray iron and steel into light gray iron and light steel. Engineers now say this largely unexplored field should expand rapidly and ultimately become a reliable source of high-grade parts, as well as a dependable alternative for static casting and for forging.

One of the method's advantages, it will be reported by E. C. Jeter, of Ford Motor Co., in January *SAE Journal*, is that of permitting parts designers to disregard machining difficulties. Other advantages will be described as uniform high quality of results and the ability of the pressure-cast parts to withstand better than double the design load.

Mr. Jeter will explain that pressure casting, performed either by rotating the mold to develop centrifugal force or by injecting air, appears applicable to mass production but probably is better adapted to selective production of parts difficult to machine.

SURVEY SUGGESTS ORDERLY WAYS OF SOLVING TRACTOR FUEL PUZZLES

CLEARLY silhouetted against a rich background of historical developments and economic considerations, an engineering analysis of the farm-tractor-fuel outlook will be a feature of the January *SAE Journal*.

Destined to stand as one of the major contributions in technical literature during recent years, the article, written by A. T. Colwell, of Thompson Products, Inc., on "Fuel Requirements for Farm Tractors," reveals an urgent need for:

- Standardization of tractor-fuel requirements so refiners can aim at a definite market;
- Classifying tractor fuels so that design engineers can evaluate tolerances, and
- Bringing uniformity into fuel tax laws so that farmers can benefit by favorable economics.

The article is a compendium of the studied opinions of tractor engineers and manufacturers, petroleum refiners and marketers, state fuel tax administrators, and farmers and their representatives, the author points out.

SAE members will be interested to know that copies of this paper have been distributed to state fuel tax authorities from coast to coast for their study, following a recent meeting of these officials who discussed the subject with the author and a representative of the SAE Tractor War Emergency Committee.

His conclusions and points suggested for further consideration constitute a milestone in the study of an engineering problem fraught with the impedimenta of economics and legislation of the 48 states.

Strange commentary on the situation is that the Germans, benefiting by perspective, appear to have hurdled all the difficulties:

They simply attach to each vehicle a plate warning the operator to use only such fuel as meets stated American requirements!

Mr. Colwell will suggest that the "ideal" fuel for tractors undoubtedly would be gasoline if certain technical and economic requirements can be worked out by refinery and tractor engineers, and policies of taxation and legislation can be made not only reasonably uniform but sufficiently broad to permit tractor users to gain the benefits of economics. Unless the situation improves, Mr. Colwell will warn, the federal government may step in with results even less happy.

War Prolongs "Teething Period" of Flying, But Promises Bright Future

WHAT flying needs are spark plugs with the longevity of overhauls for commercial planes and trouble-proof carburetors which will end an epidemic of engine stalling in private planes, Stephen H. Rolle, of Civil Aeronautics Administration, will say in January *SAE Journal*.

Characterizing the present as flying's "teething period," Mr. Rolle will express confidence that both the large engines of carrier aircraft and the small engines of privately owned planes will be better post-war. He will report that the war emergency is having drastic effects, especially in the way of changing the nature and the performance of fuels and in creating such maintenance difficulties as shortages of labor and spare parts.

Mr. Rolle, reviewing aircraft-engine failures for the two and one-half years between January 1, 1941, and June 30, 1943, actually will paint an overall picture of engine failure in the air, with highlights about as follows:

Engine Failures in Commercial Planes

Structural: Chiefly in exhaust valves, piston rings, cam assemblies, cylinder heads, rocker boxes, master rod bearings, and pistons.

Ignition: Preponderantly spark-plug fouling and shorting; difficulties additionally with ignition harness, magneto breaker points, spark-plug inserts, and magneto coils.

Lubrication: Due mainly to sticking of oil pressure relief valves and to oil leakages.

Engine Failures in Private Planes

Structural: Largest single source of difficulty; troubles chiefly with intake and exhaust valves, crankshafts, cylinder heads, cylinder barrels, link rods, and pistons.

Fuel System: Second in numerical importance; primarily engine stoppages while idling, carburetor icing, and carburetor mechanical difficulties.

Bench Tests Improving Diesel Engine Pistons

ONE of the less glamorous angles of World War II has been the success of American automotive engineers in keeping diesel powerplants going, and keeping powerplants in production, despite all the industrial upsets caused by global conflict. For instance, materials shortages alone might have been considered good and sufficient alibis. Yet accomplishment has continued, even has expanded, without benefit of music or mandates.

Take the case of the low-speed diesel engines which are used on a wide variety of heavy-duty jobs and which, pre-war, were equipped with aluminum pistons. Along came materials shortages, bringing cast-iron pistons, engineering headaches, and troubles wholesale. Yet in reasonably short order the headaches were cured, and the diesels were functioning as needed.

One chapter of this engineering story will be told in January *SAE Journal* by Research Engineer Harry F. Bryan, of International Harvester Co. It will deal with the business of rigging up bench tests for measuring the heat transfer from pistons of various designs and materials, and with the services rendered by the test methods thus developed in overcoming materials shortages.

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The Society is not responsible for statements or opinions advanced in papers or discussions at its meetings or in articles in the JOURNAL.

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"HYDROVAC" AND "BENDIX" ARE TRADE-MARKS OF BENDIX AVIATION CORPORATION

General Chairman B. E. Sibley (left) headed the committee which handled all arrangements for the successful meeting. He is talking with Lt.-Col. R. E. Jeffrey, Jr., who, following the Friday dinner, told of recent experiences in the Pacific war theater, and with SAE F&L Vice-President J. R. Sabina

F & L Men Stress New War Tasks at National Meeting in Tulsa

"THE job of matching vehicles, fuels and lubricants is an engineering job, pure and not-so-simple. It is a job of such tremendous proportions as to merit the attention of all of us put together."

Thus a message from SAE President W. S. James (read in his absence by SAE Secretary and General Manager John A. C. Warner) keynoted the scope and character of the SAE National Fuels and Lubricants Meeting held at the Hotel Mayo, Tulsa, Okla., Nov. 9 and 10. The mass of fresh data which petroleum technologists, automotive engineers and military technicians exchanged during two discussion-packed days *was* the work of a multitude of men.

From the battlefronts of Europe and the Pacific came a call for an "amphibian" grease, reports of generally satisfactory performance of existing fuels and lubricants, and details of what and why more improvements are necessary to quick victory. From GI's and Generals was collected this fighting-front know-how which was summarized at Tulsa for industry technicians alert to the need for fast action. From the laboratories of industry came the latest chapters in the long serials which tell of the search for optimum specifications for high-speed diesel fuels, for the best ways to eliminate vapor lock and a brief report on other important Coordinating Research Council projects. From both civilian and military sources was drawn a story of current progress and future needs in regard to heavy-duty oils.

Throughout the meeting were recounted the never-ending difficulties of segregating specific effects of independent elements in fuels and lubricants tests, of correlating the results of laboratory and field tests, of interpreting all tests in terms of service performance. Whether the problem under discussion dealt with diesel fuels, with greases, with oils or with other elements of relationships between engine and fuels and lubricants, these same factors loomed large as problems not yet finally solved – but problems which seem gradually to be yielding to the persistent cooperative attack of petroleum and automotive engineers.

More than 300 members and guests attended the great national gathering, and an unusually high percentage of all those registered were present at each individual session. Arrangements for the meeting were entirely in the hands of General Chairman B. E. Sibley and his Committee on Arrangements, which consisted of Mid-Continent Section Chairman John H. Baird, as local chairman; W. F. Lowe, as Secretary and Treasurer; John Day, Arch L. Foster, F. A. Suess, and W. L. Thompson. F & L Vice-President J. R. Sabina played a prominent part in the meeting and acted as chairman of the first evening's dinner session.

Face New War Needs

Immediate war problems dominated the sessions and the thinking throughout the sessions – even the progress reports on long term research studies finding discussers speaking in terms of war-potent adaptations of current results.

Army and Navy men brought news, information and new demands to the technicians with whom they have been working so closely ever since war clouds first began to loom. Among the new demands, special interest centered about the need for an "amphibian" wheel-bearing grease, which was mentioned by Army men at several sessions. The fast movement of our attacking armies has created the demand for this new product. General Purpose Grease 2-108, currently available, actually can and is being used in amphibian equipment with no difficulty *provided proper maintenance is practiced*. Frequently, when landings are made, however, there just isn't time to repack wheel bearings. Consequently the grease thins out excessively and is lost. Bearing failures result. Solution of the problem, it seems, may come either through improvement in 2-108 or through development of an entirely new product. No one seemed certain which would be the case, but it was generally agreed that the problem could and would be licked.

Another feature of the military reports which got mention from several angles was the vast importance of simple, understandable lubricating instructions for GI maintenance men. Great improvement in such instructions was reported from several service branches, but all agreed that many early difficulties resulted from their absence.

Lack of transportation and time are the real causes of military equipment corrosion problems in the Pacific, it would appear from the report made by Dinner Speaker Lt.-Col. R. E. Jeffrey, Jr., Office of the Chief of Ordnance, who had just returned from a tour of the Pacific war fronts during which he studied fuels and lubricants problems. "Corrosion is a serious problem only when rust preventive materials are not used," he said, stressing that consistent use of such materials is greatly handicapped by supply difficulties and – during invasions – by lack of time for maintenance and rust-proofing work. Rust proofing materials are performing excellently, he stated flatly, wherever and whenever they are applied properly and regularly.

Early troubles with both fuels and lubricants, he reported, have been largely overcome – and the simplification program accomplished with the aid of SAE members and the Coordinating Research Council – has been of great assistance. "Vapor lock is non-existent," Col. Jeffrey said, "gasoline gum

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GREASES

WALTER G. AINSLEY, Sinclair Refining Co.

DINNER

JOHN H. BAIRD, Lubri-Zol Sales Co.

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C. C. MOORE, Union Oil Co. of Calif.

OILS

LEONARD RAYMOND, Tide Water Associated Oil Co.

is only a nuisance at present, engine oil difficulties are unheard of." Aside from the requested "amphibian" wheel-bearing grease, a major need today is for gasoline which will remain stable through longer periods of storage.

Despite Col. Jeffrey's glowing tribute to the current performance of fuels and lubricants on the battlefronts, he pointed vigorously to the need for continued advances. "We can't coast on past accomplishments," he urged, concluding: "We have got to continue our work on gasoline development . . . the same is true of oils, greases, and rust-preventive materials. We need the continued help from the Coordinating Research Council and from SAE members . . . we need your help for the duration . . . we shall need it in the peace years to follow."

News of a just-issued U. S. Army specification for all-purpose wheel-bearing grease broke at the opening session of the second day of the meeting. Designated as U. S. Army Specification 2-108A (and superseding the existing 2-108), the new specification differs from the old in many, but minor ways – and has no relation to the hoped-for amphibian grease previously mentioned. In 2-108A, for instance, "well refined" oil will now be required, chiefly to offset psychological repercussions which arise in the field to black grease, regardless of the fact that color is no criterion of performance. Use of fatty oils has been eliminated – because such oils are not used in wheel-bearing greases of the best quality . . . and a limit of 2% of calcium or aluminum soap has been set for future mixtures with sodium.

The relatively minor character of the changes in this new wheel-bearing grease specification came as no surprise to the meeting, because it followed a detailed report on the general success of the five standard Army grease specifications which replaced the nine existing before 1942 – a report which laid particular emphasis on the satisfactory performance of Specification 2-108 under a wide range of operating and climatic conditions. "The Arctic tests and the desert tests," it was stated, "proved seasonal grades of wheel-bearing grease and water-pump grease to be unnecessary."

News that the Army is moving in the direction of performance tests to replace composition specifications in determining the acceptability of a grease was greeted with enthusiastic approval by practically all the technicians present. The only adverse comments made on the revised 2-108A specification, in fact, stemmed chiefly from the oilmen's belief that, in so far as possible, the Army should be specifying the result it demanded rather than prescribing the means by which that result should be reached.

Commend Test Progress

The fact that this trend toward performance tests is progressing slowly was commended, rather than condemned, by those who commented. Strongly favoring performance tests in principle, the engineers were equally insistent that all tests devised be well proved before being finalized.

Comment on the severity of certain phases of the Army grease specifications brought agreement by the military men that Army requirements always will be a bit more severe than would be necessary for purely commercial practice.

The special grease problems presented by military aircraft operation were given special attention at one session. AAF men stressed particularly greasing of parts not serviced in the field, where the original lubrication may be the only lubrication received during the life of the part. In this category, and named as "the most important application of grease to an airplane," was lubrication of anti-friction bearings in electrical equipment. Such bearings in one instance recently were required to operate continuously at −30 F under some conditions and at 250 F under others. Shielding ball bearings used for accessories requires a very stable grease, it was shown, because subsequent lubrication of such parts is very difficult.

Greases used on Army aircraft must be at least passable, AAF men pointed out, otherwise we wouldn't be having our current successes in all theatres. Moreover, service tests made last winter in the Arctic indicate

Three members of the committee on arrangements: (left to right) W. F. Lowe, secretary and treasurer; John H. Baird, local chairman, and F. A. Suess. Other members of the committee were Arch L. Foster and W. L. Thompson

All papers presented at this SAE National Fuels & Lubricants Meeting will appear in a later issue of the *SAE Journal* either in full in the Transactions Section or as digests.

■ ■ ■

that present greases are generally satisfactory. Nevertheless, it was indicated that all desired requirements are not being met in full, and need for continued work toward lubricant improvement was urged.

News about AAF grease specifications included announcement that 3560-E (one of three formulation specifications currently in use by the AAF) will soon be superseded by an Army-Navy performance specification – and that it is anticipated AN-G-4 will be cancelled soon thereafter. Steps are now being taken, it also was stated, to establish performance requirements for graphite grease to supersede AN-G-6.

Other news included indication by responsible AAF officers that synthetic oils and greases made from synthetic oils are showing promise. Further requirements for extreme high altitude lubrication, some officers think, may actually necessitate the use of grease made from synthetic oils. It was generally agreed, however, that many additional problems remain still to be solved in this field.

Use of hitherto untried soap bases was prophesied as probable in future development of new greases. Lithium, barium, strontium, anhydrous calcium, and other metallic soaps already have been used to some extent, it was pointed out, but further developments with these elements were predicted. The military aeronautical services, it was recalled, were pioneers in the use of lithium base greases – and might be expected to be prominent as test groups for further developments because borderline or marginal grease uses are relatively more common on aircraft than elsewhere.

CRC's Major Contributions

Through nearly every session of the gathering ran the record, results and plans of the Coordinating Research Council, jointly sustained by the SAE and the American Petroleum Institute. One whole session was devoted to the reading of two reports from subdivisions of CRC; at dinner on the opening evening CRC's Manager and Secretary, C. B. Veal, detailed the operating methods, recent results and current projects of the organization; at other sessions, CRC was commended by both military and civilian speakers for major contributions in both the fuels and lubricants fields; and its recent achievement of the Ordnance Distinguished Service Award was praised by many of those in attendance.

CRC's work in recent months was shown to cover a wide range of projects and products. Engine oil groups are attacking problems of oxidation, low temperature characteristics, SAE 50 grade oils, rust preventives, additives, foaming, oxidation, stability, and two-cycle engine requirements – and a full-scale test procedure for aviation oils is being developed. Other CRC groups are seeking an all-purpose gear lubricant; are studying vapor lock, equilibrium air distillation, and various detonation problems; are seeking required characteristics for a single universal diesel fuel; are analyzing hydraulic fluids, greases and cold-weather operation of military vehicles; and are helping to maintain

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AUTHORS

CARL GEORGI,
Quaker State Oil Refining Corp.

"Detergency or Dispersency in Heavy Duty Engine Oils?"

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Standard Oil Development Co.

Co-author: "Vapor Lock and Temperature—V/L Characteristics of Gasolines"

MAJ. N. W. FAUST,
Ordnance Dept.

"Development of Greases for Military Vehicles"

W. F. AUG,
Mack Mfg. Corp.

Co-author: "Fuel Requirements of Automotive Diesel Engines"

LT.-COL. R. E. JEFFREY, JR.,
Ordnance Dept.

"Fuels and Lubricants in the Pacific"

E. M. BARBER,
The Texas Co.

"Vapor Lock and Temperature-V/L Characteristics of Gasolines"

LT.-COM. A. D. BRABBS,
U. S. Naval Engineering Experiment Station

"Testing Heavy Duty Lubricating Oils for Naval Service"

F. C. BURK,
Atlantic Refining Co.

"Fuel Requirements of Automotive Diesel Engines"

W. A. WRIGHT,
Sun Oil Co.

"A Survey of Past and Present Trends in Lubricating Oil Additives"

C. B. VEAL,
Manager, Coordinating Research Council

"A Review of Coordinating Research Council Activities"

E. W. ALDRICH,
National Bureau of Standards

Co-author: "Vapor Lock and Temperature—V/L Characteristics of Gasolines"

NORMAN C. PENFOLD,
Armour Research Foundation

"Some Comments on Engine Testing of Heavy Duty Oils"

G. H. CLOUD,
Standard Oil Development Co.

Co-author: "Fuel Requirements of Automotive Diesel Engines"

Photographs of MAJOR S. C. BRITTON and DR. W. SCHLESINGER, Army Air Forces, co-authors of "Military Aircraft Grease Lubrication," were not available

News..

..OF THE SOCIETY

TWEC Advances Its Project On Uniform TRACTOR FUEL

PROGRESS toward standardization of tractor (distillate) fuels was given added impetus Oct. 27 at a meeting of the Tractor Fuels Committee of the SAE Tractor War Emergency Committee in Chicago, when agreement was reached to concentrate future work of this group on a fuel which may be expected to have universal distribution.

The fuel selected is the so-called "regular" fuel oil, that is: 10% 447-410, 95% 464-518, with 30 Octane Number minimum. Although it was pointed out that this specification represents a compromise of several ideas about the constituency of an optimum farm tractor fuel, the committee believed that progress might be made on standardizing this grade.

This meeting climaxed a series of events beginning with a decision by the TWEC more than a year ago to attempt some coordination of data and viewpoints concerning the then chaotic situation as regards farm tractor fuels. Highlights of events which followed were:

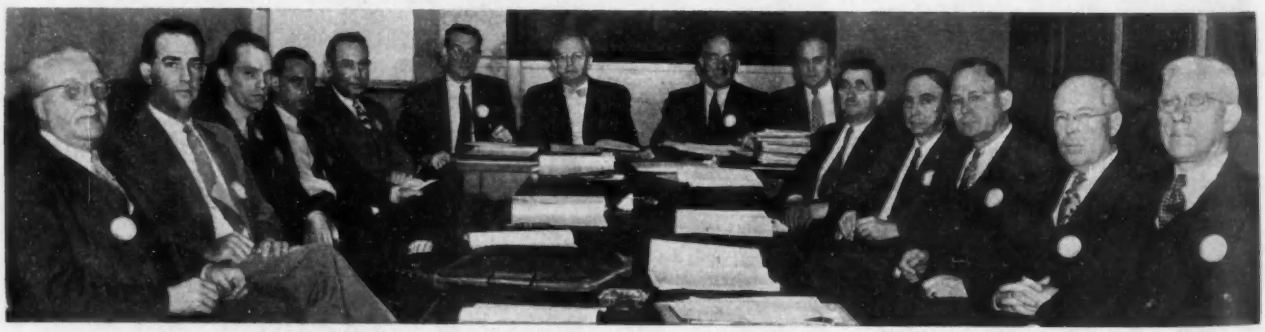
- The TWEC voted to attempt to standardize upon an adequate fuel which would be available universally to farmers, and one which might be tax-exempt;
- The TWEC Tractor Fuels Committee was appointed, with equal representation of the leading farm tractor manufacturers and petroleum technologists, under the chairmanship of W. F. Strehlow, chief engineer of the Tractor Division, Allis-Chalmers Mfg. Co.;
- Rather than develop a new specification, this committee agreed to classify the existing fuels;
- The overall problem was analyzed in a paper by SAE Past-President A. T. Colwell, vice-president of Thompson Products, Inc., at the SAE National Tractor Meeting, Sept. 13, at Milwaukee. (This paper will appear in full in the January SAE Journal);
- Representatives of the TWEC were invited to attend the annual meeting of the North American Gasoline Tax Conference of the Association of State Tax Administrators, Sept. 18, in St. Louis, to discuss phases of the TWEC program. Mr. Colwell and C. E. Frudden attended as TWEC representatives;
- At the request of TWEC, a committee of the Coordinating Research Council, Inc., headed by Walter G. Ainsley, undertook a detailed investigation of the several classifications of tractor fuels;
- Fuel refiners agreed to make the fuels selected available to tractor manufacturers to determine which are the most satisfactory in actual use. This test work has already begun.

These reports will be coordinated and submitted to state tax officials as the basis for determining the specification which may be expected to be tax-exempt for agricultural use in tractors.

Involute Spline Work Under Way

A NEW SAE standard on flat-bottomed involute splines moved another step forward toward completion as the result of a meeting Sept. 22 of a new SAE Subdivision (see photo below) of the SAE Parts & Fittings Division. The group meeting in the offices of the Buick Motor Division, GMC, agreed upon final data to be submitted to several collaborating committees, including Technical Committee 13 of the ASA Sectional Committee B-5, and the Splines Committee of the American Gear Manufacturers Association, and the National Machine Tool Builders Association. When completed, the standards will be interchangeable with the SAE AS (Aeronautical Standard) 84.

New SAE Splines Subdivision is Organized



First meeting of the new SAE Splines Subdivision undertaking to coordinate vehicle and aero work. Left to right: S. O. Bjornberg, Illinois Tool Works; Frank Sanborn, Fellows Gear Shaper Co.; Harold Inch, Jr., Detroit Transmission Division, General Motors Corp.; Clyde A. Young, National Broach & Machine Co.; Frank Blymyer, Electro-Motive Division, General Motors Corp.; R. S. Burnett, SAE staff; Charles H. Stanard, Buick Motor Division, General Motors Corp., chairman; George L. McCain, Chrysler Corp.; Stuart P. Hall and Nathan Finkelstein, Buick Motor Division, General Motors Corp.; Albert E. Leach, Pontiac Motor Division, General Motors Corp.; Harry H. Gotberg, Colonial Broach Co.; Charles R. Staub, Michigan Tool Co., and H. A. Marchant, Chrysler Corp.

AIRCRAFT
Basic Factors of Helicopter Design
Application of Aero-Economic Factors to Specific Aircraft Design
Report on Development and Application of Heated Wings
Some Experiences with Low-Drag Airfoils
Proposed Electronic Controls for Aircraft
Electronic Analysis of Airplane Braking Systems
PASSENGER CAR
Difficulties of Long-Time Ownership of Passenger Cars
Synthetic Rubber in Automotive Chassis — Status and Future Possibilities
The Future of Standardization in the Automotive Industry
The Future of Standardization in the Aeronautical Industry
STUDENT
High-Speed Motion Picture Photography
PASSENGER-CAR BODY
Symposium: Consumer Reaction to Present-Day Bodies
TRANSPORTATION AND MAINTENANCE
Cold Starting and Fleet Operation
AIR TRANSPORT
Symposium: Defining the Market for Aircraft for Local Air Transport Service
Airport Design versus Aircraft Performance
TRUCK AND BUS
Water Alcohol Injection for Spark-Ignition Engines
Power Steering for Automotive Vehicles
1945 SAE
WAR ENGINEERING
Annual Meeting
and
ENGINEERING DISPLAY
Book—Cadillac Hotel
Detroit
January
8—12
FUELS AND LUBRICANTS
Utility of Fuel
Universal Gear Lubricants
Engine Oil Foaming
MATERIALS
Metallurgy of Enemy Automotive Materiel
Some Cases for Steel as a Material
SAE Rubber Classification
Wartime Fabric Developments of Significance to the Automotive Industry
AIRCRAFT ENGINE
Detonation in Flight; Its Effect on Fuel Consumption and Engine Life
Coordinated Engine Control Mechanisms
The Primary Balancing of Radial Engines
Flow Characteristics of Induction Systems
Some Possibilities of the Turbine Compounding with the Piston Engine
PRODUCTION
Induction Heat Treatment of Internal Surfaces as Applied to Automotive Industries
Tocco Hardening
DIESEL ENGINE
Torsional Vibration—Problems and Methods of Solution
Piston Development Review
Piston Lacquering, Its Causes and Cure
SPECIAL FEATURE
Dinner Speaker
Major-Gen. Oliver P. Echols
STANDARDS
Drawing Office Practice in Relation to Interchangeable Components

PACKAGING Project by SAE Requested by ARMY, NAVY

Centralized Contact between Services and Industries Is Aim

THE Army-Navy Aeronautical Board has requested the Society of Automotive Engineers to set up a single contact between it and industry for reviewing and recommending changes in Army-Navy standards for improving the preservation and packaging of aeronautical accessories.

In compliance with this request, the SAE Aircraft Accessories and Equipment Subdivision has formed a committee on Preservation and Packaging Aeronautical Accessories (A-13), under R. L. Heath, Allison Division, General Motors Corp. This will be the centralized contact between the Government and the manufacturing industries involved to provide the military services with the coordinated engineering assistance of the leading engineers of manufacturers for the preparation of Army-Navy specifications on this subject.

This, the newest SAE aeronautical standards committee, brings the working committees of the program to 52, functioning under four general or steering committees, and the total committee membership to 368. These groups have been assigned 981 projects, including specific materials specifications, of which 706 have been completed to date.

More than three years ago the Office of Production Management, later reorganized as the War Production Board, requested the SAE to undertake a program of standardization and materials specification in the interest of increasing aircraft production. The program was enlarged by specific requests for engineering projects assigned the Society by the Army-Navy Aeronautical Board.

The first task of the new committee will be to review the A-N specifications on the preservation of bearings. This will be undertaken by a subcommittee headed by L. A. Danse, General Motors Corp., with representation of manufacturers of aircraft engines and bearings.

Tractor Tires—Post-War

BECAUSE of the success of the simplification program on farm tractor rim and tire sizes, the cooperative work of the SAE Tractor War Emergency Committee and the Tire & Rim Association is expected to continue throughout the post-war era, according to members of the TWEC.

Several dozens of sizes of rims and tires have been eliminated by the present program, which stemmed from a request of the War Production Board to conserve materials, manpower, and manufacturing facilities. The Office of the Rubber Director and WPB submitted the problem of shortages to the Farm Machinery & Equipment Division of WPB, which turned the technical phases of the problem to the TWEC.

The recommendations of the SAE committee were submitted to the WPB industry committee, which in turn advised action by WPB as a conservation measure.

Members of TWEC believe that the continuation of this type of cooperative work will have a marked effect upon the economics of the manufacturing industry, and continued work on simplification of tire and rim sizes will best serve the purposes of the farmer.

Rambling Through Se

HOW Canada, the United States, and Great Britain are coordinating their respective engineering talents on standards unification and development of better steels was described before the **CANADIAN SECTION** Oct. 18, by Neil P. Petersen, SAE councilor and past-chairman of the Section, and James G. Morrow, past regional vice-chairman of the Section, who recently returned from the Anglo-American-Canadian Conference on Screw Threads Unification, London . . . Section Chairman William A. Wecker, vice-president of General Motors of Canada, Ltd., introduced the speakers by saying "Canadian industry is greatly indebted to these men, and their associate – Section Past-Chairman James C. Armer – for their public-spirited services . . . Millions of dollars have been saved to the three countries for the development of low-alloy steels for armor-piercing shells and armor plate, a task which involved the closest teamwork of engineers on both sides of the Atlantic." . . . Highlights of the report from England included: . . . Little damage was suffered by automotive and other armament plants by the robombs . . . Despite shortage of food, shelter and sleep, British men and women are increasing output per man-hour . . . Robomb steel and explosives are inferior to those of the United Nations . . . "Extortionate" automotive hp taxes are expected to be lowered following the war, and the British industry is thinking less of producing pre-war (1939) models, and more of a type more suitable for world markets . . . Dominion Wheel & Foundries, Ltd., and McQuay-Norris Mfg. Co. of Canada were hosts . . .

Post-war trucks, released after hostilities as soon as conversion will permit, will not have the degree of novelty and advanced features many operators have been dreaming about, according to Merrill C. Horine, sales promotion manager, Mack Mfg. Corp. . . . A group of 200 commercial vehicle operators and automotive engineers at the Transportation & Maintenance Meeting of **CHICAGO SECTION** Nov. 14 heard Mr. Horine say that post-war trucks will have bigger tires and engines and better brakes . . . Larger tires will be used because they operate at lower cost per tire-mile, while higher-powered engines, built with larger bore sizes but having reduced plant weight, is a distinct trend, he added . . . Glenn W. Johnson, transportation manager, Bowman Dairy Co., acted as technical chairman . . .

Leading the list of exciting events at **DETROIT SECTION'S** Nov. 6 meeting was the talk by Dr. John T. Rettaliata, chief research engineer, Allis-Chalmers Mfg. Co., who shared with the audience some of his extensive knowledge of gas turbines . . . (Same paper heard by **CLEVELAND SECTION** Oct. 9) . . . Impressing the enormous post-war potentialities in this field upon his listeners, Dr. Rettaliata discussed the subject fully, reviewing the early history of the combustion gas turbine and its conversion to a practical form during the past 10 years; and describing its theoretical background and application in railroad and marine transportation as well as in power generation . . .

Colored motion pictures of the new Mexican volcano – Paricutin – were shown by Capt. O. O. Fisher of the Civil Air Patrol, who accompanied several expeditions into Mexico for scientific study of the site . . . Photos not only remarkable in their photography, but will prove invaluable record for posterity . . . Capt. Fisher also pleased SAE sportsmen with his shots of deep-sea fishing in Mexican waters . . .

Developing airports to serve a single metropolitan traffic center is unsound and errs on two counts, E. J. Foley, assistant to the vice-president, American Airlines, Inc., told members of **NEW ENGLAND SECTION** at its Oct. 10 meeting . . . Such multiplicity of airport facilities means duplication of land costs, terminal buildings, and so forth, and while expense of two airports may not be double that of a single large site, extravagance is inevitable . . . A second error, the speaker declared, is a complex problem of passenger and cargo interchange between the several ports . . . (Paper will appear later either in full in the Transactions Section or as a digest) . . .

SAE Treasurer B. B. Bachman, who acted as technical chairman at opening meeting of **PHILADELPHIA SECTION** Oct. 11, prefaced his introduction of the guest speaker, Major E. J. Boebinger, executive officer of the Automotive Division, Aberdeen Proving Ground, with a tribute to the small group of officers at Aberdeen who persevered in pioneer development of automotive equipment which has played such an important role in the successes of our military forces . . . Film illustrating many different types of test work done at the Proving Ground served as a corollary to Major Boebinger's talk on the subject . . . Tanks and prime movers were depicted negotiating mud streams and shell holes, amphibious craft demonstrated their versatility, and landing craft were seen depositing tanks on the shores of Chesapeake Bay . . . Views of gun firing, air cleaner testing, and the behavior of tracked and wheeled vehicles under mud and

Section Reports

snow conditions added to enjoyment of movie, which entertained the 150 members and guests who attended the meeting . . .

Nature and importance of full air cleaning on tractors and other vehicles were described to a group of 55 **ST. LOUIS SECTION** members Oct. 10 by John T. Liggett, assistant chief engineer, Allis-Chalmers Mfg. Co. . . . Crawler type tractors, in farm work particularly, work in dense clouds of dust, and this was vividly illustrated in movies Mr. Liggett brought along . . . Even still air in clean localities, he said, contains 100,000 dust particles per cu in. . . . Several rules for good air-cleaner operation which Mr. Liggett prescribed include: (1) the air intake should be as clean a place as possible; (2) the operator should be able to see the dust in pre-cleaner; and (3) oil-bath cleaner should be the right size so as not to lose oil nor fail to wet the mesh . . .

Transportation and Maintenance under Present-Day Conditions was timely subject of symposium at **SOUTHERN CALIFORNIA SECTION'S** first fall session Oct. 19, with three qualified speakers offering practical solutions to the problems of preventing failures, training personnel, and salvaging equipment . . . I. J. Wilson, superintendent of maintenance, Southern California Freight Lines, dealt with regular maintenance and overhaul procedures that avoid road failure . . . J. Arthur Elmer, Frank Wiggins Trade School, explained his own experiences in training methods that can be employed to fill vacancies and improve the efficiency of mechanics on the premises (Digest appears on p. 37 of this issue) . . . Hugh F. Scott, superintendent, Frazier-Wright Co., discussed ingenious methods in reclamation and rebuilding made necessary by shortage of new parts . . . Large display of salvaged parts was available so that members could examine samples of parts saved by many methods enumerated by the speakers . . .

Representatives of companies involved in specialized processes in the salvage field briefly explained their products . . . Al Hudson, Magnaflux Corp., described in detail how magnaflux process can be used to find fatigue cracks on steel parts . . . Another discusser disclosed that the secret of metallizing parts for reclamation lies in the preparation of the surface . . .

Same Section's new policy of alternating dinner and non-dinner meetings proved no deterrent at Nov. 9 foodless session at Ambassador Hotel in Los Angeles, when over 250 members and guests overflowed from meeting room into display rooms . . . Technical Chairman Jackson G. Kuhn, chief engineer, Kinner Motors, Inc., introduced evening's principal speaker, Lt.-Com. Karl L. Herrmann, past vice-president of the SAE, who discussed his radically new, lightweight aviation engine . . . This powerplant, which is of the "cam" type, features a greatly reduced frontal area and a 60% decrease in moving parts . . . Com. Herrmann explained the design and advantages of his engine, showing its operation by means of slides, and later, actual engine and its parts were displayed in an anteroom, to the interest of all those present . . .

Off-the-record talk on the plans and expectations the Chinese Government has for the development of its industry and trade given before **SOUTHERN NEW ENGLAND SECTION** Nov. 1 by Judge Cornell S. Franklin (or the "Mayor of Shanghai," as he is popularly called), former chairman of the Shanghai Municipal Council and veteran of a 22-year law practice in China . . . "Kaffee Klatsch" preceded evening's stellar discussion by Wilbur L. Merrill, General Electric Co., on Yankee Ingenuity in Engineering . . . Mr. Merrill cited many examples of this characteristic resourcefulness, and showed that there is a definite connection between ingenuity and engineering . . . Engineering development and design along established lines will yield a sound product, he said, but for the new short cuts to save labor and material, for the new stunt which makes the product radically better, for the new scheme which makes possible the heretofore impossible, we must look to Yankee ingenuity . . . For the sake of progress, he asserted, this trait must be recognized and developed in schools and colleges as well as industry . . .

Valuable information of past, present and future specifications of armored fighting vehicles was supplied at **WASHINGTON SECTION** Oct. 10 by Major-Gen. A. H. Gatehouse, British Army Staff, whose 28 years' experience in this field has included command of Armored Divisions at the battles of El Alamein and Alan El Halfa, where Rommel was so decisively defeated . . . "Act and Fact" title of movie showing operations leading up to and following the Invasion . . .

Methods evolved to prevent gums from sticking automobile valves in passenger-car and racing engines were outlined by Dalton Risley, Shaler Co., at **C.I.T. STUDENT BRANCH** meeting Oct. 3 . . . Kerosene was used to soften gum, but Mr. Risley declared it was ineffective as soon as it evaporated . . . Detergent oils were also tried, but they were subject to sludging due to the colloidal foreign matter that built up in them . . . The final answer was the use of a chemical which would act as a catalyst to convert the gum back into a soluble oil . . .

CRC Holding Forums On T&M Problems

A SERIES of regional forums to discuss operation and maintenance problems of knock-test equipment for motor and aviation gasolines began Nov. 27 throughout the country, under the auspices of the Coordinating Research Council, Inc.

The forums are planned to provide operators and supervisors with practical assistance in helping them overcome day-to-day operating difficulties. One of the features of the meetings will be a series of slides on "what not to do." Information on changes in equipment and modern operating techniques will be discussed and ideas which have proved useful in one laboratory will be shared with others. Schedule for the forums:

Eastern; Nov. 27-28; Philadelphia.

Chicago; Nov. 30-Dec. 1.

Mid-Continent; Dec. 4-5; President Hotel, Kansas City, Mo.; H. M. Trimble, Phillips Petroleum Co., Bartlesville, Okla., leader.

Texas; Dec. 7-8; Rice Hotel, Houston, Tex.; A. R. Stark, Humble Oil & Refining Co., Baytown, Tex., leader.

Los Angeles; Dec. 11-12; Richfield Oil Corp., Wilmington, Calif.; H. A. Mason, General Petroleum Corp., leader.

San Francisco; Dec. 14-15; California Research Corp., Richmond, Calif.; J. T. Ronan, Shell Oil Co., Martinez, Calif., leader.

These forums, which have the approval of the Petroleum Administration for War, were authorized by the Coordinating Fuel Research Committee, and are under the joint sponsorship of Dr A. E. Becker, Standard Oil Development Co., director of Operation and Maintenance Projects of the CFR Motor Fuels Division, and J. G. Moxey, Jr., Sun Oil Co., leader of the Operation and Maintenance Group Working on Laboratory Detonation Projects of the CFR Aviation Fuels Division.

The agenda for the Forums provides for a discussion of the two procedures in general use for testing motor gasolines (CFR Research Test Procedure for Determining Knock Characteristics of Motor Gasolines – CRC Designation F-1; CFR Motor Test Procedure for Determining Knock Characteristics of Motor Fuels – CRC Designation F-2) and one procedure used for testing aviation gasolines (CFR Lean Mixture Test Procedure for Determining Knock Characteristics of Aviation Fuels – CRC Designation F-3) on the morning of the first day. The afternoon will be devoted to a question and answer period on these procedures, with the exception that in the discussion of the F-3 procedure, for reasons of military security, questions concerning testing aviation gasolines above 100 octane number are excluded. Both sessions of the first day are open to all interested in the operation and maintenance of knock-test equipment.

The second day will be devoted to the discussion of problems relative to the CFR Supercharge Method of Test for Knock Characteristics of Aviation Fuels (CRC Designation F-4), and the Lean Mixture procedure in so far as it relates to testing aviation gasolines above 100 octane number, and an inspection trip to a well-equipped laboratory. Attendance at this meeting is limited to representatives of laboratories operating F-4 engines, or F-3 engines used to test aviation gasolines above 100 octane number.

SAE Representatives on Aero Mission to England

Undertaking one phase of the task of coordinating American and British aeronautical industrial standards, the three SAE members of a mission to England are shown as they were preparing for the trip across the Atlantic. Left to right are James D. Redding, SAE staff; Gustaf Carvelli, Wright Aeronautical Corp., and L. D. Bonham, Lockheed Aircraft Corp.

SEEK UNIFICATION Of Anglo-U. S. SPECS

PROGRESS toward uniformity in international aeronautical industrial standards is expected as a result of the work of the American Aircraft Technical Mission, which left recently to study at first hand British aeronautical standards and standards procedures.

As the Mission prepared to leave Washington, Flight-Lt. Douglas G. Moffitt, RAF, British Air Commission and head of the group, cited the huge potential savings in manufacturing costs of aircraft, engines and accessories through the integration of American and British standards, as well as tremendous savings in cost and time in handling maintenance work.

"An additional value will accrue in the post-war era," he said, "in expediting conversion to civilian aircraft production and in facilitating international airline operations."

A careful itinerary of the leading aircraft manufacturing centers of Great Britain has been worked out. The Mission members will be the guests of the British Ministry of Aircraft Production and the Society of British Aircraft Constructors.

The group will also inspect maintenance bases, reviewing specifications and standards affecting operation and service of fighting equipment.

"The recently published 'United States and British Commonwealth of Nations Aircraft Metals,' a cross-index of SAE and six U. S. Government series of specifications, with recommended 'interchangeable' and 'substitute' United Kingdom, Australian, and Canadian series, indicates that cooperative work in standardization is a practical business," he continued.

This cross-index, published by the British Government, the AAF Air Service Command, and later by the SAE as its Aeronautical Information Report No. 8, has received high praise of both British and American military authorities.

Flight-Lt. Moffitt, who is a member of the BAC Technical Investigations staff, was a prime mover in the earlier project and was responsible for the official appointment of the present mission.

SAE Aeronautical Standardization was begun in 1914, when a committee of the Society developed a study of the characteristics of gasoline engines for aircraft. This work was augmented by aeronautical screw threads and parts standards until 1916 when the American Society of Aeronautical Engineers merged with the SAE.

The American Aircraft Technical Mission leaving the British Air Commission, Washington, D. C., to study British aeronautical industrial standards, is composed of (left to right) Eugene W. Norris, Aeronautical Chamber of Commerce of America; Eric Dudley, Curtiss-Wright Corp., Airplane Division; Thomas P. Hearne, Ryan Aeronautical Corp.; James D. Redding, SAE staff; Gustaf Carvelli, Wright Aeronautical Corp., Flight-Lt. Douglas G. Moffitt, RAF, British Air Commission, and L. D. Bonham, Lockheed Aircraft Corp.

In 1918, Vice-Admiral Emory S. Land, then a captain in the Navy, became chairman of the SAE Aeronautical Division, and further work was done on aircraft dimensional standards.

The present SAE aircraft standardization work stems from the reorganization of the program under the chairmanship of Past-President Arthur Nutt in 1940, following a trip to France and England. Today the SAE Aeronautics Division has a total committee membership of 368, and has been assigned 706 projects by the Army-Navy Aeronautical Board, and the War Production Board.

In general, the SAE works on engine, propeller, accessory, and materials standards and specifications, and the National Aircraft Standards Committee of the Aeronautical Chamber of Commerce of America works on airframe standards. Close coordination is maintained between the SAE and NASC.

Present and Future Flange Project Is New Aero Task

THE entire range of present and the prospective future requirements of aircraft accessory drive and mounting flange dimensions is being standardized by a new committee on Accessory Drives and Flanges (E-19), appointed by the SAE Aircraft Engine Subdivision, under the chairmanship of Walter A. Hurleman, Jacobs Aircraft Engine Co.

From the present chaos of numerous sizes and shapes of drives and pads from the smallest flange and drive, such as are used for tachometers, to largest for generators and starters – and even beyond to larger sizes which are now foreseen as greater electrical output is required on future aircraft – the committee is bringing order by establishing a series of optimum sizes.

Much basic work, which will contribute to this project, has been accomplished by several SAE committees.

Members of the new committee, who represent both aircraft engine and accessory manufacturers, are John A. Lauck, Pesco Products Co.; R. J. Maci, Allison Division, General Motors Corp.; R. W. Owens, Jack & Heintz, Inc.; Norman F. Rooke, Pratt & Whitney Aircraft, Division United Aircraft Corp.; T. R. Thoron, Thompson Products, Inc.; Don Loeber, Eclipse Pioneer Division, Bendix Aviation Corp., and J. A. Robbins, Aircooled Motors Corp.

SAE Coming Events

National Meetings

Air Cargo, *Dec. 4-6, Knickerbocker Hotel, Chicago*

Annual Meeting & Engineering Display, *Jan. 8-12, 1945, Book-Cadillac Hotel, Detroit*

Aeronautic, *April 4-6, 1945, Hotel New Yorker, New York*

T & M Meeting, *May 2-3, 1945, Hotel William Penn, Pittsburgh*

Diesel F & L, *May 16-17, 1945, Carter Hotel, Cleveland*

War Materiel, *June 4-6 , 1945, Book-Cadillac Hotel, Detroit*

Tractor, *Sept. 12-13, 1945, Schroeder Hotel, Milwaukee*

Baltimore – Dec. 15

Engineers Club; buffet supper 6:30 p.m. Automotive Engineering Horizons – W. S. James, chief engineer, Studebaker Corp. and president, SAE. Guest – John A. C. Warner, secretary and general manager, SAE.

Buffalo – Dec. 11

University Club; dinner 7:00 p.m. Automotive Engineering Horizons – W. S. James, chief engineer, Studebaker Corp. and president, SAE. Guest – John A. C. Warner, secretary and general manager, SAE.

Cleveland – Dec. 11

Thompson Aircraft Products Co. dinner 6:30 p.m. Military Aircraft – Brig. Gen. Franklin O. Carroll, chief of engineering division, Wright Field, U. S. Army Air Forces, Dayton.

Detroit – Dec. 4

Horace H. Rackham Educational Memorial Bldg.; dinner 6:30 p.m. Symposium on Trends in Design and Development of Automotive Ignition, Radios, Indicating and Circuit Devices, Generators and Regulators. Ignitions – H. L. Hartzell, engineer, Delco-Remy Division, General Motors Corp. Automobile Radios – Jack Little, Chevrolet Division, General Motors Corp. Indicating and Circuit Devices – E. F. Webb, accessory engineer, Chrysler Corp. Generators and Regulators – J. S. Decker, Electric Auto-Lite Co. Chairman – P. J. Kent, chief electrical engineer, Chrysler Corp.

Indiana – Dec. 14

Antlers Hotel, Indianapolis; dinner 6:30 p.m. Future Automotive Trends – A. T. Colwell, vice president, Thompson Products, Inc.

Metropolitan – Dec. 14

Pennsylvania Hotel; meeting 7:45 p.m. Post-War Internal Combustion Engines and Fuels – T. B. Rendel, principal technical officer, British Air Commission, Washington, D. C.

Milwaukee – Dec. 1

Milwaukee Athletic Club; dinner 6:30 p.m. Probable Post-War Automobile Design Trends – F. F. Kishline, chief engineer, Nash-Kelvinator Corp.

Mohawk-Hudson Group – Dec. 12

DeWitt Clinton Hotel, Albany; dinner 6:45 p.m. Automotive Engineering Horizons – W. S. James, chief engineer, Studebaker Corp. and president, SAE. Guest – John A. C. Warner, secretary and general manager, SAE.

New England – Dec. 5

Engineers Club, Boston; dinner 6:30 p.m. Fuels and Lubricants – 1944 and Post-War – John W. Lane, assistant to chief automotive engineer, Socony Vacuum Oil Co., Inc.

Northwest – Dec. 8

Gowman Hotel, Seattle; dinner 7:00 p.m. Winter Problems with Wartime Fuels and Lubricants – R. W. Goodale, research engineer, Standard Oil Co. of Calif.

Oregon – Dec. 1

Imperial Hotel, Portland; dinner 6:30 p.m. Gasolines – Past, Present, Future – supervisor, Auto. Lab., Research and Development Department, Tide Water Associated Oil Co.

Peoria Group – Dec. 28

Jefferson Hotel; dinner 6:30 p.m. Cold Starting Engines – E. J. H. Bentz, laboratory engineer, Caterpillar Tractor Co. Civil Air Patrol – C. M. Hewitt, Bradley Polytechnic Inst. Design as Related to Field Service – D. O. Nash, general service manager, Caterpillar Tractor Co.

Philadelphia – Dec. 13

Engineers Club; dinner 6:45 p.m. Gasoline Injection – H. O. Hill, manager of Gasoline Injection and Field Engineering, American Bosch Corp.

Southern California – Dec. 8, 14, 19

Dec. 8 – San Diego Club; meeting 8:00 p.m. Helicopters. Speaker to be announced.

Dec. 14 – Ambassador Hotel, Los Angeles; meeting 7:30 p.m. Truck and Bus. Chairman – H. C. Jordan.

Dec. 19 – San Diego Club; Regular Monthly Luncheon Meeting at 12:30 noon.

Southern New England – Dec. 6

Hotel Bond, Hartford; dinner 6:30 p.m. Pratt & Whitney Aircraft Accessory Vibration Testing Machine – John Tyler. Motion Pictures. Demonstration on Freon and Liquid Air – George McCloy, and Milton Kalischer. High Speed Photography of Sound Waves with the Schlieren Method – Roland B. Bourne, Maxim Silencer Co.

Southern Ohio – Dec. 12

Van Cleve Hotel, Dayton; dinner 6:45 p.m. Development of Military Aircraft in Wartime – Col. Clyde H. Mitchell, executive officer, Fighter Branch, U. S. Army Air Forces, Wright Field.

Spokane Group – Dec. 8

Spokane Hotel; dinner 7:00 p.m. Design and Construction Post-War Trucks and Buses – John G. Holmstrom, vice president, engineering, Kenworth Motor Truck Corp.

Twin-City Group – Dec. 7

Curtis Hotel, Minneapolis; Induction Heating – T. W. Cable, director of research, Induction Heating Corp.

Western Michigan – Dec. 14

Occidental Hotel, Muskegon; dinner 6:30 p.m. Engineering Management – James M. Crawford, chief engineer, Chevrolet Division, General Motors Corp.

Wichita – Dec. 14

Droll's English Grill, buffet dinner 7:00 p.m. Equipment Requirements and Maintenance Engineering – Pan American Fleet. Motion Pictures.

Study A-N Design Specs

SAE Committee E-2, Engine Accessory Drives, has completed an assignment of reviewing 19 Army-Navy Design specifications for mounting pads, drives and accessories, Chairman G. N. Cole, Pratt & Whitney Aircraft, Division of United Aircraft Corp., announces.

The committee carefully coordinated its work with engine and interested accessory manufacturers, and the recommendations for revisions of existing standards have been forwarded to the Working Committee of the Army-Navy Aeronautical Board after a review and endorsement by the Engine Technical Committee of the Aeronautical Chamber of Commerce of America.

Progress was also reported on the review of 10 A-N D standards for a series of accessory clearance envelope drawings which will govern the maximum outlines or dimensions of accessories for installation on aircraft engines. This report, when completed, will also be forwarded to the Engine Technical Committee of the ACCA for review and, if endorsed, thence to the A-N Board.

Background to a project of this type, it was pointed out by Mr. Cole, entails a preliminary and exhaustive analysis of the standard by the committee. Its preliminary recommendations for change are then circulated to all the aircraft engine and interested accessory manufacturers for comments and criticisms. These comments are used as the basis of the committee's final report on the recommended revisions.

The report is then studied by members of the SAE Aircraft Engine Subdivision, and forwarded to the Engine Technical Committee of the ACCA, and then submitted to the A-N Board. Following a review of the rec-

ommendations, a joint meeting of the military services and the committee, designated as the ETC representative, is held to resolve controversial points, if any.

Britain, Canada, U.S. Seek Unified Threads

AGREEMENT was reached in London during August and September on several important phases leading toward international screw thread standardization by the United States, Canada, and Great Britain, members of the American-Canadian Mission reported to industry, Nov. 16 in New York.

Members of the Mission, arranged under the auspices of the Combined Production & Resources Board, are Elmer J. Bryant, chairman; James G. Morrow, vice-chairman; Cyril Ainsworth, American Standards Association; Dr. Henry W. Bearce, National Bureau of Standards; Paul J. Des Jardins, P&W Division, Niles-Bement-Pond Co.; Col. Harry B. Hambleton, Ordnance Department: Neil P. Petersen, Canadian Acme Screw & Gear Co., Ltd., and Frank E. Richardson, AAF, Army-Navy Aeronautical Board.

SAE members of the Joint Mission are: Chairman Bryant, a member of the SAE Screw Threads Division and chairman of the ASA War Committee on Screw Threads; Vice-Chairman Morrow, chairman of the Canadian Engineering Standard Association, a past vice-chairman of the Canadian Section, SAE, and a consultant to the Canadian Government, and Mr. Petersen, an SAE Councilor, chairman of the Screw Threads Committee, CESA, and SAE Canadian Section past-chairman.

The following results of the London conference were reported as being "encouraging progress" toward eliminating an important technical barrier against complete industrial coordination of the Allies:

1. Adoption by the British of American pipe thread standards of the larger sizes (over 4 in.) to be published immediately as a British Standard;

2. The British will publish as a British Standard the American Standard for Acme Screw Threads to supersede the British BS 1104;

3. Acceptance of Truncated Whitworth Threads which would fully interchange with normal Whitworth, and agreement to the modifications as a war emergency standard, and

4. Agreement that the proposed joint standard on Buttress Threads shall include recommendations for the relationship of pitch to diameter and appropriate tables of tolerances for such relationships. The British will circulate a specification with a view to early publication of a common standard.

Progress was made on the following:

1. Agreement was reached on revisions to the American war standard on Truncated Whitworth Threads (B1-6-1944), the British Standard (No. 84) to be revised in accordance therewith, and Canada will issue a corresponding Canadian Standard;

2. The Americans will revise their draft of the Acme Thread war standard as agreed upon, and the British Standard 1104 will be revised accordingly. Canada will issue a corresponding Canadian Standard;

3. British members will develop and circulate a modified BA series for fastening screws smaller than 0.06 in. diameter, and

4. United States delegates will complete a war emergency standard for the American National Threads with rounded roots, and Britain and Canada will issue corresponding standards.

Agreement was reached on these assignments:

1. Preparation of a draft specification on Cylindrical Fits by the British;

2. A draft standard on Stud Fits in High-Duty Light Alloys to be prepared by the Americans;

3. British to complete data sheets for Screw Threads for Compressed Gas Cylinders for joint publication;

4. Americans will prepare a war standard for Stub-Acme threads, in conformity to conclusions agreed upon, for adoption by the British and Canadians, and

5. Standardization bodies in each of the three countries will carry on research work outlined and supervised by the Joint Mission on the more general subject of screw thread unification. Salient point is to determine the optimum thread form.

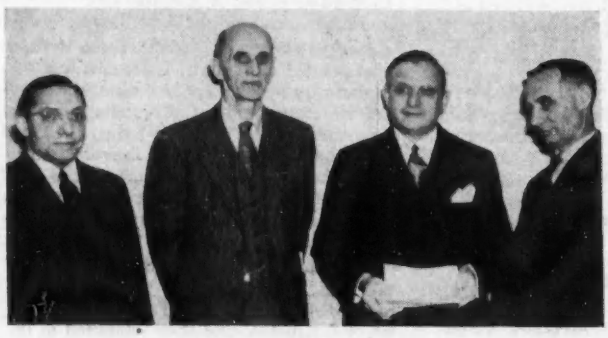
The New York meeting was sponsored by the ASA and was opened under the chairmanship of Robert M. Gates, President of ASME. Speakers included William L. Batt, Vice-Chairman of WPB, and members of the Mission.

Cincinnati New Section

THE 27th Section of the SAE was installed recently when the Cincinnati area came into its own, independent of the Southern Ohio Section, to which it had been affiliated.

Known as the SAE Cincinnati Section, the territory, in which are 92 members and which includes Hamilton and Clermont Counties in Ohio, and Boone, Campbell and Kenton Counties in Kentucky, was granted full Section status by the Council, upon recommendation of the Executive Committee of the Sections Committee.

Four meetings were sponsored by a group of eight members in Cincinnati during 1943-1944.



In their first formal pose as officers of the SAE Cincinnati Section, are (l. to r.): John M. Stoudt, secretary; A. George W. Brown, treasurer; Fred Heinlein, chairman; and Wilburn E. Meyer, vice-chairman

F&L MEETING

cont. from p. 19

satisfactory service for civilian motor vehicles under wartime conditions.

Reporting at some length on its efforts to determine the effects of ignition quality, viscosity and volatility on engine performance, the Automotive Diesel Fuels Division of CRC's Coordinating Fuel Research Committee branded as "a significant advance" the fact that, in the tests currently reported, selection of test fuels was made in such a way as to permit study of substantially independent effects of each of these three elements.

Calling the current tests a marked improvement over previous ones as regards standardization of tests procedures, the progress report's conclusions included indications that (1) cetane number seems to be important in engine starting, combustion, roughness, misfiring, and varnish formation; (2) fuel viscosity cannot be divorced from volatility in normal hydrocarbon fuels, hence these characteristics must be considered jointly; (3) for practical purposes, API gravity of a fuel can be taken as a measure of its heating value, which in this work appeared to be the most important single property affecting power and economy; (4) the present results and conclusions are in general agreement with those presented in the first CFR full-scale engine report. This committee presented also a classification of diesel fuels drawn up by a committee appointed by its chairman.

Discussion of this report disclosed widely divergent views about the relative importance of cetane number in the diesel fuel development picture. Some contended that it is of great importance, others that it will have little significance. Middle-of-the-road view, which gained the most support, pointed to lack of knowledge as the main reason for divergencies; we don't know enough about the facts. "We never will have enough facts with which to settle the argument," one prominent research engineer urged, "until we have carefully investigated cetane numbers in tests with engines specifically designed for using high cetane fuels. Nobody yet," he said, "has taken an engine, progressively raised its compression ratio, and then studied the specific effects of cetane number as he went along."

Other comments following the diesel fuel report indicated desire for data developed from a wider variety of engines and data on the possible effects of various percentages of cracked materials; the existence of a trend toward more volatile diesel fuels; and the probability that new processes will lead to production of 100 cetane fuel in case any use for it were to be found.

The second extensive CRC report was presented by that organization's Motor Fuels Division and concerned methods of applying Temperature-V/L (V = volume of vapor; L = volume of liquid in fuel system) relationships to analysis of data resulting from actual vapor lock tests. Based on an extensive series of tests, the committee presented a series of curves which showed among other things:

1. Vapor forming characteristics of several gasolines;

2. Temperature and vapor-handling-capac-

ity data for a typical fuel system;

3. Correlation of fuel system characteristics with gasoline vapor-forming characteristics;

4. Determination of bottleneck-point temperature and vapor-handling capacity under conditions of vapor lock and no vapor lock; and

5. Temperature V/L curves for fuel samples tested in motor vehicles.

Two important uses were indicated for the extensive data revealed by this report: (a) passenger car engineers are furnished with data useful in designing post-war fuel systems with minimum tendency to vapor lock, and (b) oil producers are shown a variety of pressures and volatilities which will produce the same vapor-locking tendencies. Practically applied, these data will permit increased flexibility in using the petroleum manufacturing equipment available in any given plant.

Ability to "prescribe" just the right additives for a particular lubricant designed for a particular service still remains to be achieved in the future, statements made at the meeting indicated. Experienced technicians admitted frankly the continued existence of major difficulties in correlating laboratory tests with actual service results. The extreme complexity of the factors was stressed, as was the very real need for a better understanding of the mechanisms involved during the service of a lubricant.

Too much struggle with the "specter of correlation" was partly blamed for existing difficulties by one technologist who suggested that most of the items in an "ideal" specification can be determined with sufficient directness over a wide range of temperature and catalytic conditions to evaluate the individual characteristics. Thus, he postulated, "it would seem possible to eat our pie a piece at a time with far less chance of spreading it over our faces." Admitting that such an idea might be considered idealistic, he urged that time might be saved in the long run, concluding that research methods in the future will be vastly improved, if not distinctly changed. Approach to the whole problem from a chemical laboratory rather than an engine-testing point of view was the main thesis he urged.

A proposal that the additive-treated oils, generally known as "detergent," should rather be called "dispersant" oils met with general agreement from the technologists, except for the reservation made by some that even the latter term fails to describe adequately the entire range of functions such oils actually perform. Argument for use of the term "dispersant" was based on the conclusion – drawn following long series of tests – that the main function of these additive-treated, heavy-duty oils is to prevent oxidation deposits from adhering to metal surfaces, rather than to remove such deposits after they have formed . . . to maintain clean engines in clean condition for maximum possible periods of operation, rather than to clean up dirty engines. As far as the two terms alone are concerned, no one disputed that "dispersant" is the more logical nomenclature, but it seemed clear at the end of considerable discussion that the final word had not yet been said. One discusser, for example, suggested specifically that these lubricants might best be classed as "special service oils." Their real purpose, this group argued, is for abnormal service in normal engines, or for normal service in abnormal engines.

Regardless of terminology, it was brought out, the additive type of oil has reached high levels of scientific development as compared with its status only a few years ago when an SAE paper referred to the type as "snake oils" and to the additives as "dopes." Need for proper maintenance care in connection with the use of these oils was emphasized by several commentators, and concern was expressed regarding unfavorable results which might accrue from attempted use of such oils in passenger cars after the war, when the average car engine probably will be dirtier than ever before.

All papers presented at this SAE National Fuels & Lubricants Meeting will appear in a later issue of the *SAE Journal* either in full in the Transaction Section or as digests.

■ ■ ■

Some prominent automotive men, on the other hand, feel that a straight mineral oil and a single heavy-duty oil of the Army 2-104B type might well serve all post-war needs, including passenger car. Proponents of this idea argue that the Army uses 2-104B successfully in everything from jeeps to tanks – and that, therefore, post-war use in passenger cars is not to be feared. Those opposed point out that Army vehicles were new and their engines clean when started on detergent oils and cannot possibly be compared to the average dirty civilian car engine.

Fortifying the point of view that additive-treated oils are chiefly dispersant, rather than detergent in function, were data developed from road and bench tests to indicate that, while these oils do display detergent properties on engine deposits of a soft, grease-like nature, and on those parts of an engine where oil circulation and washing occur, they are not effective cleansing agents for hard, adherent or baked deposits or in those sections where oil flow and attendant washing is limited . . . and what is more, the loosening action is actually hazardous, can cause plugging of oil pump intakes and disruption of oil circulation if adequate precautions are not taken. Removal of the crankcase pan may even be necessary to clean out the deposits dropped around the screen, some discussers suggested. There is still a long way to go before test procedures are developed which will be perfectly reliable guides to a lubricant's performance in all kinds of service, according to comments made by a variety of experienced lubricant and engine technicians. "For oil evaluation work, all of the equipment and procedures are open to criticism," one research engineer concluded bluntly, following an extensive historical analysis of all the engine testing methods developed to date and a study of currently used procedures. Particularly is this the case, it was emphasized, when the interpretation of tests results is not rather narrowly confined. He concluded also that no one engine test seems to be capable of furnishing enough information to evaluate an oil for so-called heavy-duty service, because evidence from many observers shows that engine tests may be arbitrarily adjusted either to relieve or aggravate ring sticking, varnish formation, sludge formation, and so forth.

Capping a long history of progress toward improving the value of such tests and widening their usefulness, however, it was predicted that the extensive study going forward in many laboratories, coupled with the cooperative effort of Coordinating Research Council groups, would bring increasingly potent results in the future. Prototype units, or modified versions of present test engines with revised test procedures, the engineers expect, will be of major value in tailoring new lubricants to suit the needs of higher output engines predicted for post-war usage. Nevertheless, the ever-present need for actual service experience as a basis for final evaluation was emphasized over and over again.

For the present, in other words, there was little argument with the statement that oils for heavy-duty service must be evaluated by competent observers whose judgment of mass evidence from numerous tests serves as the evaluation basis; that no known type of bench test alone is adequate for the job.

Navy Evaluates Progress

Considerable interest centered about conclusions drawn at the meeting from Naval Engineering Experiment Station tests to the effect that, generally speaking, heavy-duty oils for diesel engines have not been noticeably improved during the past three and one-half years, although definite advances do seem to have been made by a few individual producers. Evaluating these conclusions, several observers pointed to the advances the Navy has made in heavy-duty oil testing during the last few years, and to the relative severity of the Navy tests. Only 20 oils, it was pointed out, are on the Navy acceptable list – as against more than 500 on the Army list. The very special requirements of the Navy tests, some engineers felt, were responsible for the conclusion that the industry as a whole had made little improvement in additive-treated oils in the last few years; that the same conclusion would not necessarily hold if the problem were approached from the standpoint of more general requirements.

Navy technicians were found urging development of heavy-duty oils which will show engine test results at least as favorable as the combination obtained by selecting the best results of currently outstanding oils. It was brought out, however, that throughout several years of Navy test activities, about 75% of the heavy-duty oils tested have shown results better than those for straight mineral oils.

The Navy hopes, also, for an oil testing engine, results from which will correlate with results from large submarine Diesel engines, it appeared from statements voiced at one session. No exact correlation exists now, it was claimed, between heavy-duty oils tested in small test engines and in large submarine-type engines – although the oils which give favorable results in the Caterpillar D-4400 engine do also give favorable results in the big submarine units.

The SAE Hardness Number Conversion Tables (pp. 364-370, 1944 SAE Handbook) have been reprinted for ready reference on one side of a single sheet of paper. A limited number are available for distribution and members may obtain copies by writing to SAE headquarters.

About

P&W Aircraft Promotions

Arthur E. Smith, (upper left), and John L. Bunce

Arthur E. Smith has been named assistant chief engineer, Pratt & Whitney Aircraft, Division United Aircraft Corp. He was chief engineer of Pratt & Whitney Aircraft Corp. of Mo. for the past two years. John L. Bunce, formerly service manager of Pratt & Whitney in East Hartford, has replaced Mr. Smith in the Missouri plant

JOHN B. COBLE, who had been leadman and Army and Navy welder, Spartan Aircraft Co., Tulsa, Okla., is now welding instructor, War Production Training, Cincinnati, Ohio.

CHARLES S. DOERR is now employed by the Federal Works Agency, Washington, D. C., as director of motor vehicle services. He was formerly chief, War Agencies Section, Automotive Branch, War Production Board.

THOMAS O. DAHLSTRAND, formerly chief production engineer, Tinnerman Products, Inc., Cleveland, is now president of Triad Metal Products Co., same city.

EDWARD F. HAGAR, an engineer for Lockheed Aircraft Corp., Burbank, Calif., in civilian life, is now in the U. S. Navy, stationed at Corpus Christi, Tex.

FRANK W. WELLS is no longer connected with A. O. Smith Corp., Milwaukee, having joined Sawyer Electrical Mfg. Co., Los Angeles.

SGT. MOORE KELLY, JR., U. S. Army, has been transferred from the Quartermaster Corps, Camp Young, Indio, Calif., to the AAF Technical Service Command, Base Unit 400, Wright Field, Dayton, Ohio, where he is engineering specialist.

HANS FISCHER, who had been vice-president, Lanova Corp., Long Island City, N. Y., is now a consulting engineer on high-speed diesel combustion with offices in Yonkers, N. Y.

CLINTON BRETTELL, who served as assistant professor of physics at the University of Florida for the past nine months after retiring from the U. S. Army as a captain, is now under contract at Miami Technical High School as instructor in related mathematics and science for automotive and diesel engines.

RAYMOND H. KRAUSE, formerly production manager, Kiekhaefer Corp., Cedarburg, Wis., is now mechanical adviser to the Corps of Engineers, U. S. Army, Columbus, Ohio.

JOHN KEPKE has been named language technician, Army Information & Education Division, Language Section, New York City.

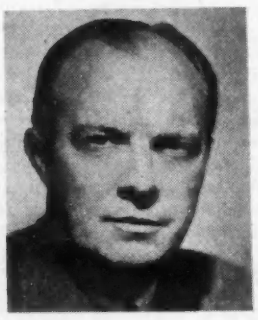
WILLIAM KNIGHT, formerly inspection methods engineer, quality engineering department, Curtiss-Wright Corp., Propeller Division, Caldwell, N. J., is now continental director of organization, Technocracy, Inc., New York City.

BOYCE W. KNIGHT has resigned his position as engineering representative, Young Radiator Co., Racine, Wis., and is now operating as a manufacturer's agent as well as handling the products of Leake Stamping Co., Monroe, Mich. His headquarters are at Racine.

I. C. SLEIGHT has joined P. R. Mallory & Co., Inc., Bearing Division, Indianapolis, as development engineer. He was formerly assistant project engineer, Wright Aeronautical Corp., Paterson, N. J.

ALLISON L. BAYLES has been elected vice-president of American Engineering Co., manufacturers of industrial machinery, Philadelphia. Mr. Bayles had been with Rogers Diesel & Aircraft Corp., New York City, where he occupied the position of director of research and development. Mr. Bayles is diesel-engine vice-chairman of the SAE Metropolitan Section.

Allison L. Bayles



ROBERT H. LOUGHRAN has left Chrysler Corp., Detroit, where he was project engineer, to become test engineer with Pratt & Whitney Aircraft, East Hartford, Conn.

Formerly industrial engineer, Trundle Engineering Co., Cleveland, **FRANK ADAMS** is now works manager for Blackhawk Mfg. Co., West Allis, Wis.

HAROLD W. AGER, JR., who had been automotive technician for the U. S. War Department, Desert Training Center, Camp Young, Calif., is now with Refining Associates, Inc., South Gate, Calif., as refinery superintendent.

ISAAC E. ALEXANDER has been appointed chief tool designer of Hughes Aircraft Co., Culver City, Calif. He had been machine and tool designer, North American Aviation, Inc., Inglewood, Calif.

NELSON E. ALEXANDER, formerly research associate at George Washington University, Washington, D. C., is now with Allegany Ballistics Laboratory, Cumberland, Md., in the same capacity.

ALBERT V. ANDREWS, previously service representative, Thompson Products, Inc., Cleveland, is now the owner of Andrews Adjustment Centre, an automobile repair shop, in the same city.

HENRY C. APPELT is now aircraft engineer, Continental Motors Corp., Muskegon, Mich. He had been process engineer, Norge Division, Borg-Warner Corp., Muskegon Heights, Mich.

J. E. TRAINER, vice-president in charge of production, Firestone Tire & Rubber Co., has been awarded an Army Ordnance citation for distinguished service in the war, as a result of his work as assistant chairman of the Intermediate Caliber Antiaircraft Carriage Industry Integrating Committee since January, 1943. The citation declared that Mr. Trainer "has rendered distinguished service to his country in the struggle to maintain the freedom of all people. By the exercise of his initiative and ingenuity he had made a marked contribution to the war production program." It is believed to be the first such award made in the rubber industry.

J. E. Trainer

t SAE Members

Heads Indiana Standard Oil Co.

Dr. Robert E. Wilson has been appointed chairman of the board and chief executive officer of Standard Oil Co. of Ind., succeeding Edward G. Seubert. Dr. Wilson was president of Pan American Petroleum & Transport Co., Standard's eastern subsidiary.

B. O. **BURRITT,** formerly chief engineer, Marquette Metal Products Co., Cleveland, is now connected with Federal Machine & Welder Co., Warren, Ohio.

ROBERT H. BELL, U. S. Army, may be reached at Section S, 3704 Base Unit, Keesler Field, Biloxi, Miss. In civilian life he was engineering draftsman for Douglas Aircraft Co., Inc., El Segundo, Calif.

Previously with American Aviation Corp., Jamestown, N. Y., as director of the Quality Control Division, **EARL J. SWAILES** is now staff assistant to the production supervisor, Glenn L. Martin Co., Baltimore, Md.

CHARLES A. COOK has severed his connection with Fuller Mfg. Co., Kalamazoo, Mich., as executive engineer, to become assistant chief engineer in charge of transmission engineering with Wisconsin Axle Division, Timken Axle Co., Oshkosh, Wis.

GUY T. M. BEVAN has been advanced from chief engineer to vice-president of engineering and research, Massey-Harris Co., Ltd., Toronto, Canada.

ELTY C. GUIOU, who is with New England Telephone & Telegraph Co., Boston, has been changed from motor vehicle supervisor to division supervisor of motor vehicles, Metropolitan Division.

WILFRED G. BURGAN, chief of the Wheeled Vehicle Section, Manufacturing Branch, Office of the Chief of Ordnance-Detroit, has received the highest honor the War Department can confer on a civilian in wartime – the award for Exceptional Civilian Service. The award, similar to a military campaign ribbon, was accompanied by a citation signed by Secretary of War Henry L. Stimson, which acclaimed Mr. Burgan for "his contribution to the war effort by collaborating in the invention, perfection and patent of a tow bar so designed that it may be used universally with all types of military vehicles. It has been adopted by the Army, Navy and Marine Corps."

Wilfred G. Burgan

RAY C. ELLIS, formerly director, Radio and Radar Division, War Production Board, Washington, is now connected with General Motors Corp., New York City. Before entering Government service, Mr. Ellis had been with the Delco Radio Division of GMC. He recently returned from a three-month trip to

Ray C. Ellis

Russia, when he represented the WPB in discussion with Russian industrialists bearing on technical aspects of lend-lease supply problems in the electronics field.

Previously engineer in charge of binding machinery development, R. R. Donnelly & Sons Co., Chicago, **ROBERT DEAN EASTON** is now mechanical engineer, California Rotogravure Co., Los Angeles.

CHARLES H. COLVIN is now an engineering consultant with offices in New York City. He had been director of the Guggenheim School of Aeronautics, New York University.

JOHN I. CICALA, a first lieutenant in the U. S. Army, has been transferred from Desert Proving Grounds, Camp Seeley, Imperial, Calif., to the Office of the Quartermaster General, Washington, D. C.

Formerly research manager, Lion Oil Refining Co., El Dorado, Ark., **JOHN W. POOLE** is now chief, California Transition & Engineering Office, National Defense Research Committee, which has headquarters in Washington, D. C.

ALBERT A. ARNHYM, consulting engineer, Solar Aircraft Co., San Diego, Calif., whose paper on Comfort Requirements of Military Aircraft appears in digested form on p. 44 of this issue, has written a book around the same subject entitled "Comfortization of Aircraft," published by Pitman Publishing Corp., New York City. In his book, however, Mr. Arnhym deals with commercial as well as military aircraft, and has assembled all the technical data, calculations, information and illustrations necessary to aid in eliminating the discomforts inherent to flying.

ARTHUR J. FRANCK, formerly chief tool engineer, Micromatic Hone Corp., Detroit, is now assistant chief engineer, Special Machine Division, Sav-Way Industries, same city.

EDUARD C. PETRY has been appointed supervisor of fuels and lubricants engine research, Armour Research Foundation, Chicago.

Formerly in the sales department of McCord Corp., Detroit, **NEIL McMILLAN, JR.** is now with Banian Corp., same city, in a similar capacity.

PHILIP R. MARVIN, who had been chief metallurgical engineer, Bendix Aviation Corp., Brooklyn, N. Y., has been named director of research and development, Milwaukee Gas Specialty Co.

JOHN D. MacCARTHY, who had been chief supervisor of tools and gages, Remington Arms Co., Bridgeport, Conn., is now general superintendent of tool production, General Motors Corp., Eastern Aircraft Division, Linden, N. J.

JOHN S. MALONEY may be contacted at Connecticut Hard Rubber Co., New Haven, Conn., where he is aeronautic vibration engineer. Mr. Maloney was 1943-1944 secretary-treasurer of the SAE Southern Ohio Section.

ENSIGN JAMES PETER HUNSAKER, USNR, has been transferred from the U. S. Navy Bureau of Ships, Boston, Mass., to the

Engineering Experiment Station, Annapolis, Md.

VERN Z. PERRY, formerly plant manager in charge of production and engineering, Blue Bird Body Co., Fort Valley, Ga., is now with Ward Body Co., Conway, Ark., working on passenger bus body designing and production planning.

ROBERT M. L. LINDQUIST is now an ensign in the U. S. Navy, and is stationed at the Naval Ordnance Laboratory, Washington, D. C. He had been an instructor at the University of Minnesota, Minneapolis.

KARL R. KROENING, formerly superintendent of equipment, Schuylkill Valley Lines, Inc., Norristown, Pa., now has the same position with Delaware River Coach Lines, Inc., and Trans Bridge Lines, Inc., Broadway, N. J.

Previously project engineer, Ternstedt Mfg. Division, General Motors Corp., Detroit, **JAMES H. LEWIS** is now product engineer, Oldsmobile Division, GMC, Lansing, Mich.

GEORGE F. KUTZELMAN, formerly instructor, Woodrow Wilson Vocational High School, Baisley Park, L. I., N. Y., is now employed by East New York Vocational High School, Brooklyn, N. Y., in the same capacity.

ROBERT W. THOMAS, who had been fleet manager, Coca Cola Bottling Co. of N. Y., Inc., New York City, is now director of distribution, Quality Bakers of America Co-op., Inc., same city.

Flying, like all human endeavors, progresses by evolution and not revolution. Such is the theme of "The Coming Air Age," a blueprint of tomorrow's aviation world by Reginald M. Cleveland and Leslie E. Neville, consulting editors and directors of Aviation Research Associates, which was recently published by Whittlesey House, McGraw-Hill Book Co., Inc. In a simple, definitive outline of the steps by which aviation will approach its real maturity as a power for peace, the authors answer everyday questions about the airplane and its impact on our future way of living. They discuss geography of the air, freedom of the air, airlines of tomorrow, and consider the probable status, both technical and financial, of the industry when the war ends. Mr. Cleveland and Mr. Neville give their authoritative descriptions of the giant superplane, the helicopter, the rocket ship, new power sources, as well as more typical craft of the predictable future; and finally, analyze air-age education from a national and international viewpoint.

Leslie E. Neville (left), and Reginald M. Cleveland (right), co-authors of "The Coming Air Age"

That's no fish story W. W. Churchill is telling, but live evidence of what pulling a fast one means. Mr. Churchill, who is superintendent of operations and maintenance, Washington Motor Coach Co., Inc., Seattle, Wash., modestly agreed to a full-size close-up of his "whopper"

C. E. VAUGHN, fuels and lubricants engineer, Standard Oil Co. of Calif., has been transferred from the San Diego to the South Laguna, Calif., branch of the company.

THOMAS FAY BERGMANN has moved to Wright Aeronautical Corp., Paterson, N. J., as sales engineer, from Wright Aero, Ltd., Los Angeles, where he had the same position. Mr. Bergmann was 1943-1944 vice-chairman of the SAE Southern California Section.

DAVID JUKOFF, who had been employed by the National Advisory Committee for Aeronautics, is now in the U. S. Navy, and may be reached at the Naval Air Station, Moffett Field, Calif.

THOMAS G. MURPHY, who had been chief chemist, Franklin Creek Refining Corp., Franklin, Pa., is now with Barber Asphalt Corp., New York City, as assistant general manager of manufacture. He is a past vice-chairman of the SAE Pittsburgh Section.

CHARLES J. DALTON, formerly director, Post-War Policy Division, American Type Founders, Inc., Elizabeth, N. J., is now a consulting engineer with offices in Cleveland, Ohio.

RALPH DOMJAN is no longer with Tide Water Associated Oil Co., New York City, as automotive engineer, having joined Service Analysts, Inc., same city, as chief engineer.

ABNER KAPLAN, U. S. Army, has been transferred from Camp McCoy, Wis., and may now be reached at A. P. O. 17508, c/o Postmaster, New York City.

Formerly sales and service engineer, Carter Carburetor Corp., St. Louis, Mo., **WILLIAM F. HAGENLOCH** is now associated with Lenk, Inc., Boston, Mass.

DONALD S. MACDONALD, a first lieutenant in the U. S. Army, has moved from the Ordnance Branch, Pine Bluff Arsenal, Ark., to the School of Military Government, Charlottesville, Va.

ENSIGN THEODORE CHANOUX, U. S. Navy, is stationed at the U. S. Naval Frontier Base, Tompkinsville, S. I., N. Y. In civilian life he was tool designer, Krautter-Weber Tool Co., Newark, N. J.

PAUL R. CHURAN, formerly senior engineer, Johns Hopkins University, Applied Physics Laboratory, Silver Springs, Md., is now project engineer at the University of Michigan, Detroit.

JOHN W. OEHRLI has accepted a position with McCulloch Aviation, Milwaukee, Wis. He was formerly assistant professor of mechanical engineering, Penn State College, State College, Pa.

WILLIAM REX BRASHEAR is now production planner, Laister-Kauffmann Aircraft Corp., St. Louis, Mo. He had been employed by Mines Equipment Co., same city. Mr. Brashear is a past-chairman of the SAE St. Louis Section.

WILLIAM E. BRIECE, who had been president of Bill Briece Co., Kansas City, Mo., is now division manager, Pacific Airmotive Division, Airplane Mfg. & Supply Corp., same city.

J. D. ROACH, formerly with Hyatt Bearings Division, General Motors Corp., is now associated with Bower Roller Bearing Co., Detroit, as sales engineer.

RAYMOND F. COOK, previously draftsman for Allison Division, GMC, Indianapolis, is now tool and die designer for Hoffman Specialty Co., same city.

Formerly development engineer, Goodyear Aircraft Corp., Akron, Ohio, **RICHARD J. CERNY** is now flight test analyst, Consolidated Vultee Aircraft Corp., San Diego, Calif.

ROBERT VAUGHAN BROWN has been named plant engineer, Lubri-Zol Corp., Cleveland. He had been assistant professor at Case School of Applied Science, same city.

PERRY A. CLARK is no longer with United Aircraft Service Corp., East Hartford, Conn., as field service representative, having joined Transcontinental & Western Air, Inc., Kansas City, Mo., as powerplant engineer.

GABRIEL MALKIN, formerly product engineer, Allen Engineering Co., Detroit, is now project engineer, Engineering Service & Machine Co., New York City.

ARNE FEROY is development engineer for his own company, Arne Feroy. He had been development engineer, Rogers Diesel & Aircraft Corp., New York City.

Formerly assistant chief designer, Donnelly Powers Engineering Co., Inc., Detroit, **HUGO G. FRIES** is now the owner of Auto City Designers, same city.

A former student of Lawrence Institute of Technology, **EDWARD KOCZAT** is now in the U. S. Navy, stationed at Great Lakes, Ill.

HUSTON G. WELCH, U. S. Army, has been transferred from Camp Charles Wood, N. J., to Headquarters Detachment 4201, S.C.S.U., Fort Monmouth, N. J.

W. S. BRADFIELD, formerly flight test engineer for Allison Division, GMC, Indianapolis, is now a graduate assistant in the wind tunnel laboratory, California Institute of Technology, Pasadena.

Previously purchasing agent, Frost Gear & Forge Division, Clark Equipment Co., Jackson, Mich., **L. C. BOOTES** is now treasurer for Jackson Auto Sales, Inc., same city.

PERCY H. BALLANTINE has joined Anken Co., Newton, N. J., as night superintendent. He had been an engineering assistant at Titeflex, Inc., Newark, N. J.

H. C. AUMENT, who had been with Brown Bros. Mfg. Co., Inc., New York City, as an engineer, is presently connected with Graham-Paige Motors Corp., Detroit, as assistant to the president on manufacturing.

THOMAS BACKUS, previously chief engineer for R. G. Le Tourneau, Inc., Peoria, Ill., now has the same position with Fuller Mfg. Co., Kalamazoo, Mich.

KENNETH G. BACHELLER has been named research engineer for Raymond Engineering Laboratory, Inc., Berlin, Conn. He was formerly resident engineer, Jacobs Aircraft Engine Co., Pratt & Whitney Aircraft Division, East Hartford, Conn.

FRANK BAKER has left Wright Aeronautical Corp., Paterson, N. J., where he was production test inspector, and is now employed by the Diesel Development Division, American Locomotive Co., Schenectady, N. Y.

WALTER BISHOP, formerly assigned to industrial relations, Wright Aeronautical Corp., Paterson, N. J., is now personnel manager, Wadell Engineering Co., Orange, N. J. Mr. Bishop, a former member of the SAE Metropolitan Section Governing Board, is chairman of the SAE Placement Committee and is a member of the SAE Student Committee.

Walter Bishop

Changes in Company Status

H. L. Adams

Stephen Du Pont

N. F. Adamson

D. E. Gamble

T. R. Farley

C. Bockius

W. A. Ashton

Recent changes in company status have been received by the following SAE members: **H. L. ADAMS,** Weatherhead Co., Cleveland, from estimate supervisor to assistant to the president; **STEPHEN DU PONT,** Indian Motorcycle Co., Springfield, Mass., from assistant chief engineer in charge of research and development, to chief engineer; **N. F. ADAMSON,** Twin Disc Clutch Co., Racine, Wis., from chief engineer to general sales manager; **D. E. GAMBLE,** Borg & Beck Division, Borg-Warner Corp., Chicago, from vice-president and general manager to president; **T. R. FARLEY,** Caterpillar Military Engine Co., Decatur, Ill., from executive vice-president to president; **CHRISTOPHER BOCKIUS,** American Machine & Foundry Co., New York City, from director of engineering to director of business research; and **W. A. ASHTON,** Aircraft Accessories Corp., Burbank, Calif., from assistant chief engineer to chief production engineer.

SAE members in the Armed Forces who have received promotions include: **JOHN H. FRYE** and **WALTER G. BAIN,** Inspection Division, Wright Field, Dayton, to colonelcy; **PAUL F. NAY,** Wright Field, Dayton, **JOHN R. BIRD, GEORGE A. CHADWICK, JR.,** A. P. O. 345, Camp Swift, Tex., and **C. O. FRENCH, JR.,** Wright Field, Dayton, to lieutenant colonelcy; **WARREN C. LANDIS,** Office of the Chief of Ordnance – Washington, **EMMONS S. LOMBARD,** Washington, D. C., **RICHARD U. BRYANT,** Watertown Arsenal, Mass., **JOHN F. BOLGIANO,** Wright Field, Dayton, **ALAN H. BLAIR,** Wright Field, Dayton, **GEORGE N. CHAMBERS,** 1380th Service Unit, Philadelphia, and **JAMES I. CLOWER,** have been raised to major; **JOSEPH W. CORLEY,** Roswell, N. M., **TRUMAN W. HOWARD, JR.,** Wright Field, Dayton, **JULIUS F. KOETSCH,** Camp Pendleton Airfield, Oceanside, Calif., **JOHN KANDARIAN,** Whittemore Service Command Base Shop, Ayer, Mass., **ROBERT G. BILL,** Aberdeen Proving Ground, Md., **W. A. MAST** and **HERMAN C. CUSKIE,** Fort Leonard Wood, Mo., to captaincy.

In the Navy the following men have been promoted to lieutenant (jg): **RALPH E. CARLSON,** Rensselaer Polytechnic Institute, Troy, N. Y.; **RAYMOND Z. FARKAS,** Bureau of Ships, Washington, D. C.; **MORRIS G. AVERY; S. E. ELLERBE,** Naval Aircraft Factory, Philadelphia; and **HARRY S. GERSTUNG,** Annapolis, Md.

C. B. ROSENBERG has joined the staff of George Washington University, Cumberland, Md., as project engineer. He had been a mechanical engineering instructor at Swarthmore College, Swarthmore, Pa.

WILLIAM P. MICHELL, who recently returned from Great Britain where he had been serving in an advisory capacity on military truck transport at the invitation of the British Government, has been appointed assistant chief engineer of Mack Trucks, Inc., New York City. Mr. Michell, a member of the SAE General Standards Committee, (Motorcoach and Motor Truck Division), had been assistant to the chief engineer at Mack Mfg. Corp., Allentown, Pa.

William P. Michell

JAMES M. SMITH is no longer mechanical engineer for Mack Mfg. Corp., Plainfield, N. J., having joined Aluminum Co. of America, Cleveland, as project engineer.

EARLE E. SHINER, a former student of A. & M. College of Texas, is now in the U. S. Army, and may be reached at the 378th Ordnance, M.A.M. Company, Camp Shelby, Miss.

Formerly field lubrication engineer, Service Analysts, Inc., New York City, **C. M. MYERS** is now affiliated with Mack-International Truck Corp., Troy, N. Y., as representative covering that area.

MAJOR C. G. WOOD, Ordnance Department, has been transferred from the Lima Tank Depot as commanding officer to Headquarters, Cleveland Ordnance District, as acting executive officer.

R. W. BORGERS, U. S. Navy, who had been at the Station Hospital, Bryan Field, Tex., may now be addressed at College Station, Tex.

LT. (jg) GEORGE H. LANCASTER, USNR, has moved from Fort Schuyler, N. Y., to the Bureau of Ordnance, Research Division, Washington, D. C.

DEAN DRISCOLL, formerly an engineer in plant maintenance, Thompson Products, Inc., Cleveland, has been commissioned an ensign in the U. S. Navy, and is stationed at Raleigh, N. C.

G. M. GIANNINI, who had been president, Autoflight Corp., Burbank, Calif., is now the president of his own company, G. M. Giannini & Co., Inc., Pasadena.

PAUL E. GERY has been named project engineer, Borg-Warner Corp., Research Laboratory. He was formerly production engineer, Detroit Diesel Engine Division, GMC.

Previously general manager of Globe Machine & Stamping Co. and executive vice-president, Warren Refining & Chemical Co., Cleveland, **DON H. GEARHEART** is now vice-president, Globe Division, Hupp Motor Car Corp., same city.

FRANCIS GALDO, formerly designer, Monroe Industrial Engineering Co., Detroit, is now with Progress Engineering Service, same city, in a similar capacity.

MAJOR MURTEN G. HIETT, U. S. Army Ordnance Department, has been transferred from the Office of the Chief of Ordnance-Detroit to the Ordnance Service Command Shop, Chicago.

CARTER S. COLE, previously chief of the Metals Branch, Conservation Division, War Production Board, Washington, D. C., is now connected with the American Society for Testing Materials as staff engineer.

COL. HARRY ADAMSON, U. S. Army Ordnance Department, may now be reached at A. P. O. 502, c/o Postmaster, San Francisco, Calif. He had been stationed at Fort Crook, Neb.

ALBERT B. CHAMBERLIN, JR., USNR, has moved from Great Lakes, Ill., to the Navy Pier, Chicago.

GEORGE LEONARD TRUBIN, U. S. Army, has moved from Camp Sibert, Ala., to Edgewood Arsenal, Md.

NORMAN E. HARPER, previously standards supervisor, Parker Appliance Co., Cleveland, is now chief engineer, Carpenter Tool & Mfg. Co., same city.

SAE student members newly engaged in engineering work at various production plants throughout the country include:

	Formerly at	Employed by
JACK MARTIN YOUNG	Case School of Applied Science	Warner & Swasey Co.
TREVOR FINK	Case School of Applied Science	Cleveland Pneumatic Tool Co.
JOHN C. HOUSTON	Chrysler Institute of Engineering	Chrysler Corp.
TOIVO W. HUURTO	Chrysler Institute of Engineering	Chrysler Corp.
JORMA O. SARTO	Chrysler Institute of Engineering	Chrysler Corp.
JACK RINDNER	College of the City of New York	Airadio, Inc.
SEYMOUR LIEBERMAN	College of the City of New York	York Research Corp.
MAURICE G. CRAGUN	General Motors Institute	Allison Division
WILLIAM H. LICHTY	General Motors Institute	Cadillac Motor Car Division
L. C. RAUCH	General Motors Institute	Frigidaire Division
MAYO M. REICHARDT	Lawrence Institute of Technology	Differential Wheel Corp.
ROLAND V. FISCH	Ohio State University	International-Stacey Corp.
CHESTER L. REED	Oregon State College	Lockheed Aircraft Corp.
THOMAS F. WARDLE	Pratt Institute	Arma Corp.
MAURICE J. COLLINS	University of Detroit	General Electric Co.
CHARLES D. MOORE	University of Michigan	Chrysler Corp.

MASON D. HANES has joined Andover Motors Corp., Elmira, N. Y., as assistant chief engineer. He had been design engineer, Pratt & Whitney Aircraft, East Hartford, Conn.

Formerly Eastern manager, Roadmaster Products Co., Chicago, **RALPH R. GUNDERSON** is now sales manager of Power Controls Division, Aircraft Accessories Corp., same city.

ROBERT W. COLBURN is employed as chief designer and installation engineer, Conkle & Co., Miami, Fla. He was formerly test engineer, Aircraft Engine Division, Packard Motor Car Co., Detroit.

HUNT and COLWELL JOIN SAE War Engineering Board

J. H. HUNT, General Motors Corp., and A. T. Colwell, vice-president, Thompson Products, Inc., both past-presidents of the Society, have been appointed members of the SAE War Engineering Board, Chairman James C. Zeder, chief engineer, Chrysler Corp., announced. Other members of the SAE W.E.B., as now constituted, are:

B. B. Bachman, vice-president and chief engineer, The Autocar Co.; Don R. Berlin, General Motors Corp.; L. R. Buckendale, vice-president, Timken-Detroit Axle Co.; R. E. Cole, vice-president, Studebaker Corp.; J. M. Crawford, chief engineer, Chevrolet Division, General Motors Corp.; F. F. Kishline, chief engineer, Nash Motors Division, Nash-Kelvinator Corp.; R. H. McCarroll, Ford Motor Co.; Arthur Nutt, chairman, SAE Aeronautics Division; C. R. Paton, Packard Motor Co.; L. S. Pfost, chief tractor engineer, Massey-Harris, Inc.; D. G. Roos, vice-president, Willys-Overland Motors, Inc.; C. G. A. Rosen, director of research, Caterpillar Tractor Co.; E. H. Smith, Packard Motor Co.; R. R. Teetor, vice-president, Perfect Circle Co., and Louis Thoms, General Motors Corp.

Besides Messrs. Hunt and Colwell, Messrs. Bachman, Nutt, Roos and Teetor have served as SAE presidents, and Mr. Crawford is president-elect for 1945.

SAE student members who have recently been employed by the National Advisory Committee for Aeronautics include: **FRED P. VAN DAME,** formerly University of Detroit; **JOHN PALASICS,** formerly Penn College; **LAWRENCE J. GALE,** formerly Northwestern Technical Institute; **ERNEST CHANES,** formerly College of the City of New York; **RICHARD NIEMI,** formerly College of the City of New York; **DONALD R. DIGGS,** formerly Northwestern Technical Institute; **T. E. JUUL,** formerly University of Detroit; **JOHN TOMA,** formerly Case School of Applied Science; and **SAUL RUBIN,** formerly Case School of Applied Science.

SAE PRESIDENT WILLIAM S. JAMES, who discussed Post-War Highway Traffic at the annual banquet of the Institute of Traffic Engineers in Chicago, Oct. 3, declared: "Speed controls are necessary for the safe and efficient use of our highways, but they are only one of many factors in highway safety. They should be reasonable and the engineering program should make certain that they fit the design of the highway and the traffic it carries. The educational program should include information and instruction on other operating practices as well as on proper operating speeds and the advantages of different maximum speeds under different conditions. The enforcement program should crystalize the educational and engineering efforts into actuality. In brief, our post-war motor vehicle safety program should be based on accident facts and not scarehead fiction."

GEORGE H. KENDALL is now a consulting mechanical engineer with offices in Noroton Heights, Conn. He had been chief engineer, Sargent & Co., New Haven, Conn.

FRED W. GROSS, formerly New Jersey representative, Wayne Pump Co., Newark, is now administrative inspector, U. S. Army Signal Corps, same city.

F. LESLIE JACOBUS, who had been automotive engineer, Sun Oil Co., New York City, is now project engineer, Elastic Stop Nut Corp., Union, N. J.

ARTHUR P. EMMERT, former vice-president in charge of manufacturing, has been named president of Warner Gear Division, Borg-Warner Corp. He succeeds C. S. DAVIS, Borg-Warner president, who has headed the Warner Gear Division since 1932. Mr. Davis has retired from the presidency of Warner Gear to give his exclusive time to the parent corporation in Chicago.

SAE members who have received recent changes in company status include: **JACK A. NELSON,** Standard Oil Co. (Ind.) from diesel representative to diesel engineer; **J. W. BOND,** Leece-Neville Co., Cleveland, from spare part manager to specification engineer; **IRVING G. BOHRMAN,** Perfex Corp., Milwaukee, Wis., from sales manager to manager of the Radiator Division; **CARL J. BOCK,** GMC Truck & Coach Division, Pontiac, Mich., from truck division engineer to assistant chief engineer of trucks; **JOHN A. BOLL,** U. S. Rubber Co., Detroit, from sales Manager of the Automotive Tire Division to manager of automotive sales department; **CARLTON W. BOLLER,** Pratt & Whitney Aircraft, East Hartford, Conn., from detailer to layout draftsman; **PAUL J. BOEGER,** National Advisory Committee for Aeronautics, Langley Field, Va., from assistant mechanical draftsman to engineering draftsman; **WILLIAM TILDEN DAVIS,** Wright Aeronautical Corp., Paterson, from senior technical writer to supervisor of copy, Publications Division; **HAROLD LEWIS CULLINGS,** Aircooled Motors Corp., Syracuse, N. Y., from assistant research engineer in charge of laboratory to chief experimental engineer.

Also, **JOHN A. BRITTON, JR.,** Stanco Distributors, Inc., New York City, from assistant manager, Chemical Products Division, to sales manager; **BLY A. CORNING,** AC Spark Plug Co., General Motors Division, Flint, Mich., from factory service representative to supervisor of precision inspection; **EDWARD S. COBB, JR.,** Wright Aeronautical Corp., Paterson, from test engineer to senior test engineer; **ELMER J. BRYANT,** Greenfield Tap & Die Corp., Greenfield, Mass., from chief engineer, Gage Division, to director of research; **CLOYD L. BUGERT,** Toledo Industrial Rubber Co., Toledo, Ohio, from manager of sales to secretary; **J. H. DUNN,** Aluminum Co. of America, has been transferred from the Pittsburgh office to the Development Division, New Kensington, Pa.; **WILLIAM E. KELSEY,** Bendix Products Division, Bendix Aviation Corp., South Bend, Ind., from production engineer to development engineer.

Also, **MAXIMILIAN C. FRINS,** Mack Trucks, Inc., Plainfield, N. J., from engineer to automotive and standardization engineer; **JACK C. FETTERS,** Allison Division, General Motors Corp., Indianapolis, from assistant to the general manager to engine development engineer; **ROY BRADLEY FISHER,** Pratt & Whitney Aircraft, East Hartford, Conn., from detailer to layout draftsman; **FREDERICK H. DUTCHER,** Columbia University, New York City, from associate in mechanical engineering to assistant professor of mechanical engineering; **CARL F. WISMEYER,** C. F. Wismeyer & Co., Brussels, Belgium, from chairman of the board and managing director to owner and president; **CHARLES BEHRENS,** senior quality engineer, Glenn L. Martin-Nebraska Co., who had been working at J. I. Case Co., Burlington, Iowa, may now be reached c/o Goodyear Aircraft Corp., Akron, Ohio; **ALFRED KRIEG,** International Harvester Co., Chicago, from assistant chief engineer in motor trucks to manager of gas power engineering department; **HARRY C. DUMVILLE,** General Motors Corp., Detroit, has been transferred from the Fisher Body Division to the New Devices Section, where he is assistant director.

Also, **THOMAS L. BAKER,** National Stamping Co., Detroit, from assistant general manager to vice-president and general manager; **W. F. BORGERD,** International Harvester Co., Chicago, from chief engineer, refrigeration and electrical equipment, to manager of Engineering Refrigeration Division; **CHARLES W. ANKLAM,** C. M. Hall Lamp Co., Detroit, from chief engineer to general manager; **GEORGE E. BOCK,** Whiting Corp., Harvey, Ill., from chief of aviation development to the Research Division; **EDWIN L. FISHER,** Dodge-Chicago Plant, Division Chrysler Corp., from senior engineer to project engineer; **H. RALSTON GIBBONS,** Hyatt Bearings Division, GMC, Harrison, N. J., from head of design and research to assistant chief engineer; **L. DUKE GOLDEN,** Perfect Circle Co., Hagerstown, Ind., from sales engineer to engineering educational and editorial director.

Also, **WARREN K. LEE,** Wilkening Mfg. Co., Philadelphia, from project manager to general factory manager; **ARTHUR A. LOCKE,** Wayne University, College of Engineering, Detroit, from associate professor to professor, head of the aeronautical engineering department; **LESTER C. LICHTY,** Yale University, New Haven, Conn., from associate professor to professor of mechanical engineering; **ALBERT H. LANGENHEIM,** Dayton Malleable Iron Co., Dayton, from assistant to the president to general manager; **JOHN J. A. O'HARA,** Ministry of Aircraft Production, London, England, from assistant technical officer to technical officer in the directorate of research and development of engines; **C. HUBERT SMITHSON,** Guiberson Diesel Engine Co., Dallas, Tex., from service liaison engineer to project engineer; **PHIL S. ADAMS,** General Petroleum Corp. of Calif., from automotive engineer in Los Angeles to division manager of commercial sales, Seattle, Wash.; **MAX HOFFMAN,** American Bosch Corp., from assistant chief inspector in Springfield, Mass., to field engineer, Cleveland; **AUGUSTUS B. KINSEL,** from chief metallurgist, Union Carbide & Carbon Research Laboratories, Inc., to vice-president, Electro Metallurgical Co., New York City, both subsidiaries of Union Carbide & Carbon Corp.; **FRED S. MACKEY,** Allis-Chalmers Mfg. Co., from works manager, Supercharger Works, Milwaukee, to general works manager, West Allis Works, West Allis, Wis.

Also, **BRUCE W. KLEIN,** Pontiac Motor Division, GMC, Pontiac, Mich., from supervisor of experimental data section to project engineer; **FRANK F. KERNS,** Guiberson Corp., Dallas, Tex., from project engineer to work on special assignments; **DON R. KEATON,** Whirlwind Lawn Mower Corp., Milwaukee, from chief engineer to plant superintendent; **RUSSEL J. KELLER,** B. F. Goodrich Co., Akron, Ohio, from manager, airplane wheel and brake department to development engineer; **EUGENE V. GRUMMAN,** Bullard Co., Bridgeport, Conn., from expediting and cost engineer to engineer foreman, Experimental Hydraulics Division; **JOHN W. GRAHAM,** Union Oil Co. of Calif., Los Angeles, from assistant manager, foreign general shipments, to manager of foreign sales; **WILLIAM HARRIGAN,** The Texas Co., New York City, from automotive engineer to consulting technologist; **DONALD E. JAHNCKE,** Chrysler Corp., Plymouth Division, Detroit, from tool engineer to plant layout engineer.

Also, **P. B. HAYNES,** Spicer Mfg. Corp., Toledo, Ohio, from master mechanic to manager of the mechanical division; **GORDON M. GUILBERT,** Twin Disc Clutch Co., Racine, Wis., from advertising manager to Michigan District sales manager; **JOHN T. HAYFORD,** Pan American World Airways, Atlantic Division, La Guardia Field, N. Y., from junior engineer to flight engineer; **VINCENT H. HOEHN,** U. S. Rubber Co., Mishawaka, Ind., from assistant chief engineer, Fuels Cells Division, to chief engineer; **BRYAN E. HOUSE,** Bendix Products Division, South Bend, Ind., from engineer to chief engineer, military brake engineering; **ARTHUR JOHN KAUPER,** Harley-Davidson Motor Co., Milwaukee, from assistant foreman to experimental engineer in charge of experimental testing department; **ALFRED KAUFFMANN,** GMC Truck & Coach Division, Pontiac, Mich., from special assignment engineer to project engineer.

OBITUARIES

Thomas Midgley, Jr.

Most frequently honored American scientist of the past two decades, Thomas Midgley, Jr., died suddenly on Nov. 2 in his home in Worthington, Ohio. He was strangled in his sleep by a harness he had devised to help him get into and out of bed. He had suffered partial paralysis for the past four years.

An enthusiast for youthful research workers, he frequently said that man's best creative work was done before forty. However, much of his most important work was accomplished during the last 15 of his 55 years of vigorous life as an organizer and administrator of numerous research projects, a contribution to the advancement of technologies which he believed transcended his own research and development work.

Cited as the discoverer of tetra-ethyl of lead gasoline, inventor of the currently-used non-toxic refrigerant, and early research worker on synthetic rubbers and plasticizers, a co-inventor of the process used to extract bromine and other minerals from sea water, Dr. Midgley was always generous in giving full credit for his achievements to his associates. Despite his physical disabilities he served the Government in the development of a number of secret military projects both as vice-chairman of the National Inventors Council and on special projects as a consultant to various Government agencies. He had filed patents on more than 100 of his own inventions.

He was the only man in the history of the American Chemical Society to serve concurrently as chairman and president, and had received the most distinguished chemical awards and citations in this country and

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Technical IDEAS for ENGINEERS

Briefed from pa

UBIQUITOUS JEEP, Spawned of War, Ingenuity, Cooperation, Is Typical American Product

by D. G. ROOS
Willys-Overland Motors, Inc.

▪ **Metropolitan, Oct. 12**

(Abstract from paper on the engineering, design, economics and application of the jeep)

TRACING through the maze of engineering headaches solved to produce one of the world's most famous military vehicles, SAE Past-President D. G. Roos, vice-president of engineering, Willys-Overland Corp., gave Metropolitan Section a "back of the scene," blow-by-blow description of the birth and development of the jeep.

Probably never has a vehicle engineering staff been faced with more extreme weight considerations than were presented by the first specifications written by the Army in this development, the author thought, and the practical requirement of getting such a vehicle in mass production rapidly required compromises with existing manufacturing facilities.

The jeep, Mr. Roos said, is a typically American development, because ingenuity, rather than experience and research, was the basis on which it was developed. Neither the time nor the facilities were available for anything else.

Starting with the inception of the project as far as Willys-Overland was concerned, Mr. Roos indicated that SAE Past-President A. W. Herrington, had suggested to Willys the Army's probable interest in a small vehicle. He then sketched in detail the steps leading from there to the original production order for 16,000 of the final model.

On July 15, 1940, Willys-Overland received specifications and a request to bid on 70 light vehicles, delivery to be in 75 days from receipt of order. The engine was to develop 85 lb-ft torque and the vehicle was to weigh only 1250 lb. It appeared impossible to Willys to meet such requirements, so the engineering department proceeded to write its own specifications around a vehicle designed to meet the general specifications laid down by the Army, but modified to be able to accommodate the 4-cyl engine that had been used in the Willys passenger car.

Sample Car Built

A sample car was built despite the fact that Willys did not get the order because it could not promise delivery of 70 vehicles in 75 days. This first Willys model involved many problems that were solved with considerable ingenuity.

To start with, use of the Willys engine imposed a weight disadvantage of about 100 lb over the smaller and lighter engine used by American Bantam. The engine was also so high that it was just barely possible to squeeze it in under the 40-in. cowl height limit imposed by the Army. Willys' decision to use its existing engine, despite these problems, was based on the fact that the engine had been thoroughly tested and it was felt that the extra power would increase tremendously the usefulness and acceptability of the vehicle. The engine developed 105 lb-ft torque, had 134 cu in. displacement, and delivered 63 hp – as against 45 hp for the engines used in the vehicles of the other manufacturers.

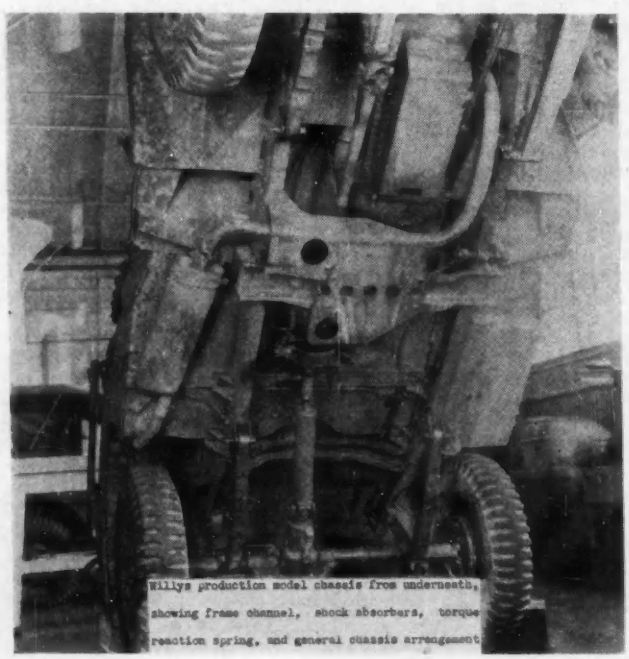
Since there was so little time for development work and testing, it was necessary to use many components from the standard Willys passenger car.

Some parts, however, were not as simply specified. One of the most difficult problems was the working out of a front axle for the 4-wheel drive unit. It was finally found that Spicer Mfg. Co. had developed an axle equipped with a hypoid differential of the right size for a passenger car that could be made the basis for a front and rear axle for the proposed vehicle. It was necessary, however, to redesign this axle to conform to the Willys left-hand engine, Mr. Roos added.

A view of the chassis from underneath is shown in Fig. 1.

The model was finally completed and delivered to Camp Holabird, Md., on Nov. 11, 1940, where it underwent a protracted and searching series of tests. It was necessary, however, to remove 300 lb from its weight before the Army would consider it as a production prototype.

A detailed check was made of every part in the car, Mr. Roos said, for Willys did not want radically to change the engine. About 115 lb were shaved off of the body



Willys production model chassis from underneath, showing frame channel, shock absorbers, torque reaction spring, and general chassis arrangement

▪ Fig. 1

★ ★ ★

and 35 lb from the frame. Another 18 lb was saved on the front seats, 11 lb on the gasoline tanks, 14 lb on the windshield, and the aprons were omitted from the fenders, saving 12 lb more. Even the paint came in for its share of weight study, 9 lb being saved by more careful spraying. It was an exacting job, but it was successful, for when the new vehicle was built and put on the scales, it weighed 2154 lb—as against the specification requirement of 2160 lb, maximum.

The Army liked this job, too, but paradoxically, the Army insisted that many of the items on which Willys had slaved to take out the last ounce of weight be replaced by standard Quartermaster Corps parts, often adding many pounds to the weight. The proposed generator, for instance, had to be replaced for the QMC standard unit, and a heavier voltage regulator had to be used, as well as standard combat wheels and 6.00-16, 6-ply tires, and an extra bracket in the rear to carry a 5-gal auxiliary gas tank. The standard tires and combat wheels added 60 lb and the gasoline tank another 5 lb.

The Army also insisted on a 15-gal gasoline tank. To get this item in, it was necessary to make it L-shaped and hang it down under the seat. Then, a box had to be placed below the tank to protect it on rough terrain. The box had to be provided with drainage holes, fitted with removable sealing caps.

Then the carburetor had to be redesigned, so the vehicle could operate at tilts of 20 deg on either side, and 55 deg up or down.

The problems to be solved had been many, but an order for 16,000 of these ¼-ton, 4 x 4 trucks was immediately forthcoming. This particular model, known as the MB truck has become more popularly known the world over as the jeep.

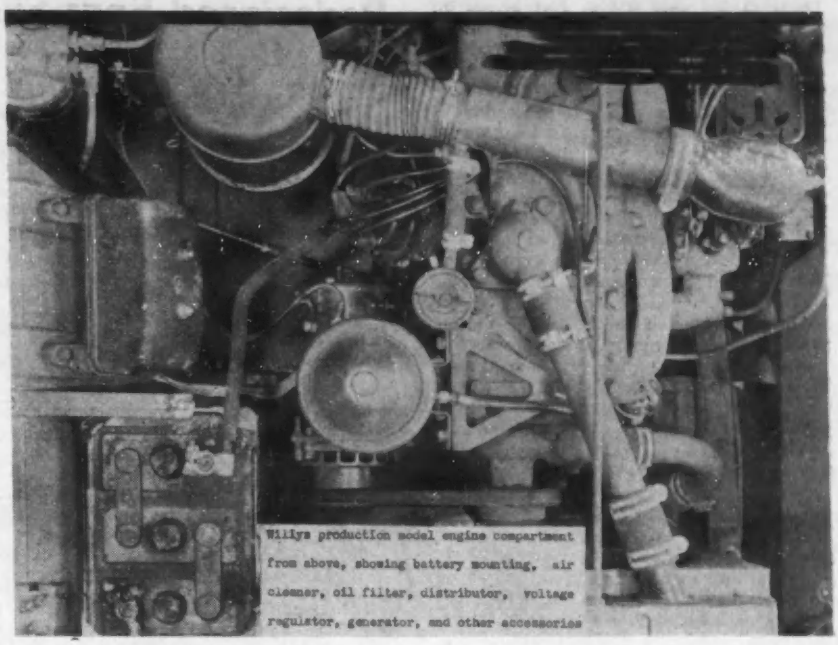
It has an 80-in. wheelbase and an overall length over the spare tire of about 132¼ in. At 50 mph it has a cruising range of 116 miles without tow load. At its maximum speed of 65 mph, it has a gasoline consumption of 10½ mpg, which increases to 25¼ mpg at 30 mph. Gross weight is 3125 lb.

Jeep's Reserve Power

One reason for the jeep's popularity on landing beaches, over rough fields, and in all climatic conditions is its reserve power, Mr. Roos said. The Willys passenger-car engine, a 4-cyl, L-head unit with a 3⅛-in. bore and 4⅜-in. stroke, giving a 134.2 cu in. displacement, was chosen as the powerplant because it was tooled up for production and had been widely tested in actual service in the hands of owners.

The vibrations in the engine at the higher rpm required, made it necessary to mount all accessories to withstand vibration or independently, by means of flexible connections. The air cleaner is connected to the carburetor by means of a flexible hose that had to be flattened slightly at one point, as shown in Fig. 2.

All in all, the engine compartment is a marvel of compactness. The only thing that could be added, Mr. Roos suggested, would be poured-in cement.


Willys production model engine compartment from above, showing battery mounting, air cleaner, oil filter, distributor, voltage regulator, generator, and other accessories

■ Fig. 2

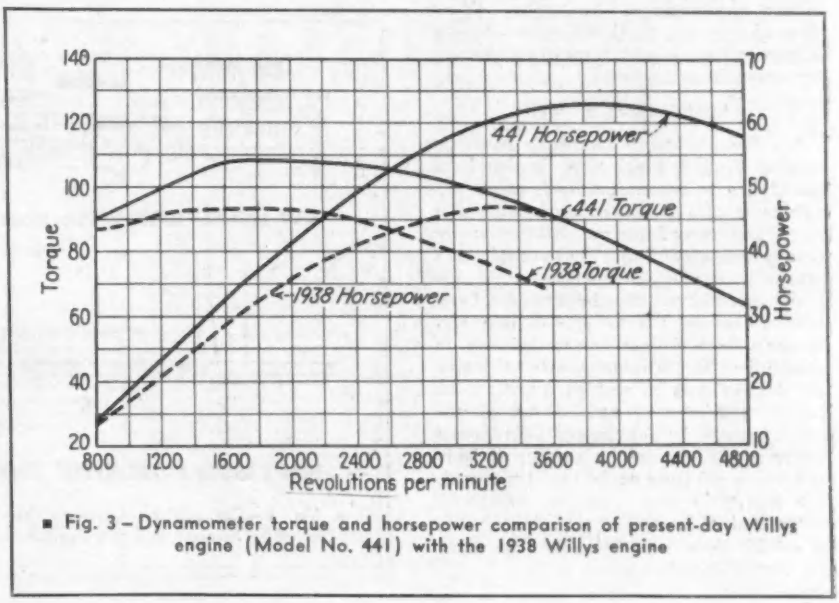
The gear shift levers are fitted so that the car can shift from the 4-wheel drive to rear-wheel drive, giving higher speeds on level roads. The shift to the 2-wheel drive is locked out in the low-gear range to avoid excessive torque on the rear axle.

For several years prior to incorporation in any of the jeep models, a series of engine tests was run to bring the operation of the engine up to higher speeds without failure, through strengthening numerous parts. At first, failures from piston seizure, cylinder blocks cracking, and cylinder-head troubles kept the tests short. Finally, after weeks of day-and-night painstaking work the engine was developed to the point where it was possible to run it at 4400 rpm for 100 hr without failure. This last test is still used about every 10 days to check production. Thus was demonstrated again, Mr. Roos said, American ingenuity of its unadorned best.

Development Work

Mr. Roos cited three typical examples of the types of intensive development work that had to be undertaken to make the jeep into a thoroughly reliable and sturdy vehicle. There were many others but these three examples show what can be accomplished with a design by intensive study of the causes for failure and using every possible resource of material and design that can be used without changing the basic design of the units involved.

Example one was the transmission, which



■ Fig. 3 – Dynamometer torque and horsepower comparison of present-day Willys engine (Model No. 441) with the 1938 Willys engine

failed in the sand test at Fort Meade on the first test in approximately 3 hr, and which showed bad pitting of teeth on the first-speed transmission gears at the end of 3½ to 4 hr, and a failure of needle bearings in the clutch pinion at the end of 8 hr. All three of these causes of failure were attacked by first using floating bushings in the countershaft clutch gear instead of pressed-in bushings and providing adequate oil to them, by the use of Amola steel in the cluster gears instead of nickel steel, and making use of the constant-mesh clutch pinion gear and cluster gear to act as an oil pump to supply oil to the needle bearings in the clutch pinion and by raising the oil level in the transmission. Transmission life was increased by a ratio of 10 to 1 with these minor changes and lifted the whole gear box out of the danger zone.

A second example was given in the intensive study of the Tracta constant-velocity type of joint which was used in the front axle as optional with the Bendix-Weiss, constant-velocity joint. Here it was found that stress risers existed in certain sections of the forked ends of the drive shafts which caused failure in anywhere from 27,000 to 70,000 cycles on the fatigue test set up. By actually reducing some of the section where the stress risers existed and spreading out the stressed area so that the stresses were less concentrated and by shot blasting, the life of these members was raised to 200,000 cycles without failure, which was considered adequate.

A third example was the development of the jeep engine itself, which, over a period of two years, underwent intensive study in every detail resulting in changing the engine from one which gave 45 hp at 3200 rpm (Fig. 3) and an extremely short life on block test at wide-open throttle and high speed, to an engine which regularly undergoes a life test of 4400 rpm at wide-open throttle for 100 hr without failure. These tests and studies covered changes from iron to aluminum pistons; a study of cylinder-head sections and stresses, pressure as well as water distribution; a study of main bearing loads and the effect of flywheel mass and counterweighting; an intensive study of cam design and valve-spring design; a study and alterations of the method of feeding oil into the bearings and rods, and finally, a very careful analysis of the study of the pneumatics of the engine. All of these changes preserved the original tooling of the engine and were made without interrupting its production.

Modifications of Jeep

Mr. Roos mentioned numerous modifications of the jeep which were developed for the Ordnance Department, such as the development of a 6 x 6 armored car, ambulance, and general carrier. Another modification was made into a snow vehicle. An especially interesting modification of the jeep was developed for the Airborne Division where the weight of the jeep was brought down from 2300 lb to 1305 lb using all of the basic units, such as engine and transmission, as well as steering gear, frame, transfer case, and so on, of the standard jeep, by substituting light metals wherever possible, and by making all body and seat metal parts out of plastic plywood. The jeep has a great many post-war applications and an intensive study is being made of modifications to make it more adaptable for farm and civilian use.

Redesigned Spar Systems Effect Savings in Building War Planes

by J. F. SCHIRTZINGER
Douglas Aircraft Co.

▪ **1944 National West Coast Aeronautic Meeting**

(Excerpts from paper entitled "The Development of Spar Caps with Integral Fittings")

THE information presented herein deals primarily with the considerations that resulted in the selection of the present design of the main wing spars for a recent twin-engine military airplane, on which the spar system is of particular importance because the entire bending load in the wing is carried by the spars.

Seek Reduced Splice Weight

The original purpose of the cost study made was to determine if certain splices and their consequent weight could be eliminated without incurring material and machining costs over $10 per lb. At about this point it was suggested that even the splices between the cap and lug type fuselage fittings might be eliminated by incorporating this fitting as an integral part of the inboard extrusion. An ideal cap was conceived which consisted of this integral fitting and a constantly tapering tee section involving no splices at any point along its length.

The design of the integral fitting spar is of interest because it represents a case in which the structural efficiency was maintained at a virtual ultimate, and the usual compromises were avoided by the development of radical manufacturing methods.

A rapid picture of the structural and manufacturing cost of the taper splice joints may be obtained by examining the exploded sketches in Fig. 1, which show the large number of pieces involved in the old design, as compared with the integral fitting design.

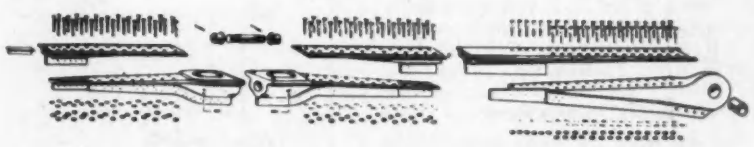
The cost study involved: (1) determining the weight of the taper spliced joint as a function of load; (2) determining the cost of the taper spliced joint as a function of load; (3) evaluating weight, and determining the expenditure justified by the elimination of splices; and (4) obtaining a combination of raw material and fabrication cost that would be within the limitations established by item 3.

There are three main sources of weight in the typical spliced joint: (1) there is an increase in the combined area of the aluminum caps through the entire splice; (2) there is an increase in weight due to the taper in the transition between the regular spar section and the splice section required to eliminate stress concentrations and provide material to resist bending loads; (3) there is the addition of bolt weight, which includes weight involved in the replacement of aluminum with steel in the bolt holes, and the weight of the bolt heads, washers and nuts.

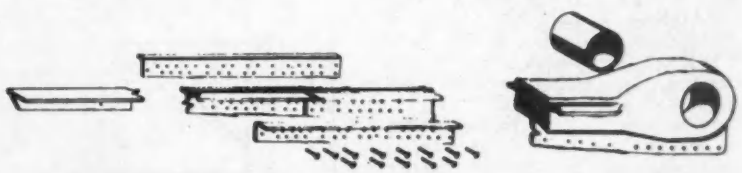
In order to determine more completely what savings exist in eliminating splices, a study was made of the so-called direct costs of a splice. The answer plotted into curve form as a total load cost (see Fig. 2) gave the magnitude of the savings which accompanied the elimination of splices.

In addition to weight and cost savings, there were other advantages in using the integral type cap. First, it was recognized that the exposure of the bolt heads in the airstream was an aerodynamic penalty against the spliced design. Second, the installation of the splices meant that a relatively large area of mating steel-aluminum surfaces were exposed and subject, because of the press fit, to stress corrosion.

The history of the integral spar cap from this point on was a series of attempts to reduce the material cost to within the predetermined economic limits. Several schemes were attempted to avoid the low utilization of blank material, and the high cost of ma-

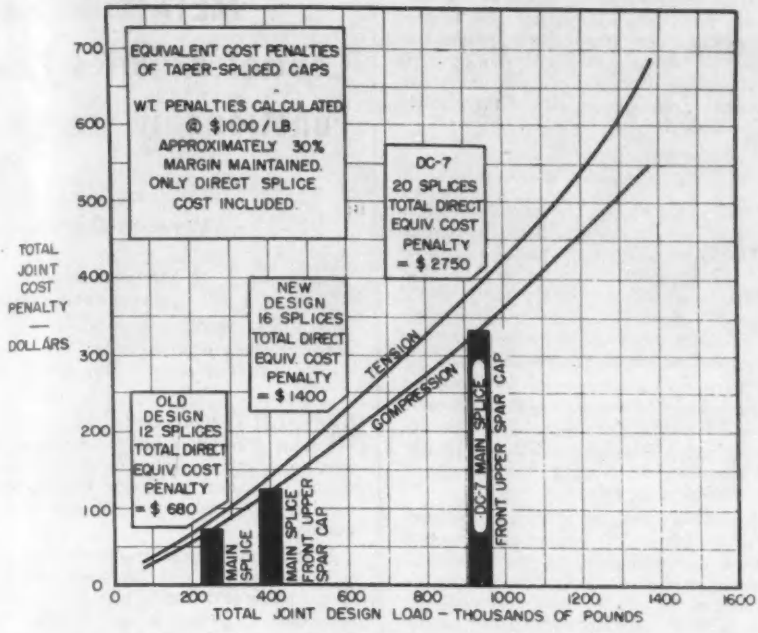


OLD DESIGN MAIN UPPER SPAR CAP ASSEMBLY - 275 PIECES



NEW DESIGN FRONT UPPER SPAR CAP ASSEMBLY - 18 PIECES

▪ Fig. 1 – Comparison between the large number of pieces involved in the old design and the number used for the integral fitting design



■ Fig. 2 – Total load cost, giving the magnitude of savings which accompanied the elimination of splices

terial removal which the integral fitting involved.

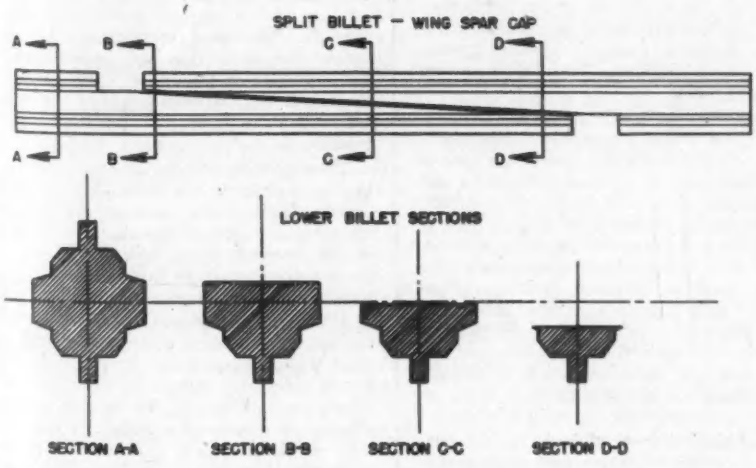
The method which was eventually adopted, and which proved to be the most economical, consisted of utilizing the material which would normally be lost in chips to fabricate a second spar cap. This was accomplished by designing a bar shape which, when split diagonally lengthwise, would give two tapering section billets from a length of bar little greater than would otherwise be required for one. The bar shape required involved only a slight increase in cross-section area over the single billet, and, therefore, resulted in a much greater utilization of raw material. A layout of this arrangement is shown in Fig. 3.

We may make the following conclusions with respect to the integral fitting spar cap development, as it applies to new airplanes:

1. The integral fitting spar cap will be produced at an actual monetary saving as compared with the conventional spliced design.

2. The investment in special machinery, though very large, is adequately offset by the above saving, and the weight saving is, therefore, accomplished without cost.

It is expected that in projected quantities, the integral fitting design will result in a direct cost saving of about $2,000,000. The direct saving, including weight evaluated at $10 per lb, will be about $7,500,000. The additional cost of the special machinery required by the integral design, compared to the conventional spliced design, is about $1,000,000. Thus, the final cost savings will be about $1,000,000 in actual dollars and cents and $6,500,000 including the value of weight.



■ Fig. 3 – Layout of bar shape which resulted in greater utilization of raw material

. . . . . TRAINING On "In-Plant" Basis Unites Jobs, Study

by J. ARTHUR ELMER
Frank Wiggins Trade School
■ **Southern California, Oct. 19**

(Excerpts from paper entitled "Training Mechanics on Premises")

A LITTLE over a year ago the Southern California Truck Owners Association, organized labor, the Office of Defense Transportation, War Manpower Commission, and the Office of War Production Training started a course for truck mechanics' helpers. The U. S. Office of Education paid for the training and the Office of War Production Training furnished the teacher and equipment.

Although the program was satisfactory from a training standpoint, most men, after the course, were employed in shops over which the WMC had no jurisdiction. Finally, the present "in-plant" training program was inaugurated and started in the bus shops of the Los Angeles Railway Co., and I was the instructor.

Ingenuity Helped the Teacher

I started with a class of 13, most of whom knew nothing about a motorcoach. I prevented them from ruining the coaches completely by writing a step-by-step procedure in pencil and giving one to each pair of trainees. I rechecked the procedure as I passed from job to job, and later had the corrected version typed for future use. Thus, I was able to instruct 13 men while they were doing productive work, with a minimum of legwork. Soon I had a method for the 200 odd jobs to be found on 23 types of motorcoaches.

Parts Shortage a Sore Spot

Many equipment failures and the scarcity of equipment proved a source of difficulty in our shop. Any training program should start with the simplest jobs and pick up the more complex ones as the trainee develops in skill and knowledge. Also, the learner should be kept at one job until he knows it thoroughly. None of this could be done, however, for the following reasons:

Service jobs on a motorcoach fall roughly into 12 divisions. On 23 different types this multiplied to give about 200 jobs, all varied in some way. With 100 equipment failures (the daily average), we have been faced with as many as 40 different kinds of jobs, leaving no room for a one-job man.

The class was to run a maximum of 600 class hours, but we found very few men or women of today's applicants capable of becoming a good helper in that time. Therefore, the class has been lengthened to 1200 class hours. We have been able to return several to their jobs in 800 hours.

If anyone is interested in having a class set up in his shop, contact J. Douglas Wilson, supervisor of War Production Training, and an instructor will be furnished by the WPT. The only requirement is to keep a minimum of eight trainees on hand for him to teach, and give him work to teach with.

HUMIDITY . . . . . Proves to be Serious Air Operating Hazard

by B. A. ROSE
Lockheed Aircraft Corp.

▪ **1944 National West Coast Aeronautic Meeting**

(Excerpts from paper entitled "Humidity Effects on Airplane Equipment Performance")

HUMIDITY has a direct damaging influence on an airplane and equipment by setting up corrosion, producing mechanical interferences when ice is formed, or interfering with materials in general.

Hydraulics – Requirements of hydraulic systems have become more critical with extreme altitude operating conditions so that the pressurized reservoir has become almost a necessity. To maintain pressure, air is introduced into the reservoir by means of pumps, aspirators, and so forth. Depending upon intake conditions, invariably water is thus introduced into the hydraulic oil. The rise in temperature of the hydraulic oil will tend to get rid of the water, but under cold starting conditions the water will be distributed throughout the system. Even though hydraulic oil may be dry when it is poured into the system, a fraction of 1% of water can easily be absorbed within a short time from condensation or laxity in handling. Corrosion is apt to result, in which case corrosion inhibitors should be provided in the hydraulic oil.

Ice Formation Checked

Difficulties have been experienced in the hydraulic turboregulator when ice forms and plugs the balance line to the exhaust stack. Improvement can be obtained by increasing the line size and installing a trap, as well as rerouting the lines so that local heating is more effective. Further difficulties have been experienced in which non-metallic materials absorb moisture and swell.

Fuel tanks frequently accumulate water even though the fuel may be dry when it leaves the refinery. Water absorption will frequently occur within a short time from condensation, and it is necessary to drain all low spots periodically in the system. Ice formed from the absorbed water can be rendered ineffective by proper consideration of line sizes, carburetor de-icing, and so forth.

Engine oil tanks and the brake system must be checked, and the water drained therefrom.

Electric – Humidity has a pronounced effect upon the electrical system and components. Corrosion and freezing of contacts in voltage regulators have either overloaded the generator and caused it to fail, or have drained the battery. Replacement of these regulators by newer types, such as the carbon pile, has eliminated this difficulty.

Corrosion from accumulated moisture in electrical disconnect plugs is a constant source of trouble. In the tropics, magnetos short out due to high humidity. One solution has been to coat the magneto and associated connections with marine glue to keep the moisture out. Plastic-filled ignition harnesses absorb moisture, and though pressurized harnesses show considerable improvement, complete solution of the problem lies in basic design.

Battle Against Moisture

Moisture collecting in conduits has been so severe in some cases as to flood the conduit and fill junction boxes. Some relief has been obtained by drilling holes at all low spots and in junction boxes so the water would drain. Plastic covering on grouped wires also requires holes in the bottom so that moisture can be drained.

Collection of moisture and ice formation on the contacts of switches and relays cause much difficulty. Better sealing against breathing, reduction in volume which can breathe and mounting the equipment in a warmer area minimize the effects.

Mechanical – Mechanical devices are usually sufficiently well lubricated so that corrosion of the working parts is minimized. However, with loss of the lubricant or the exposure of unprotected parts, corrosion does occur with the resultant malfunction of the unit. Formation of ice may cause seizure or jamming of the unit as well.

More Aids in Stopping Corrosion

Serious corrosion, resulting in seizure of sealed ball bearings on the carburetor push-pull rods, has been experienced. Difficulties of this nature can be lessened by sealing all voids with the base lubricant, thereby preventing introduction of moisture by breathing, as well as periodical checks.

Push-pull rods with sealed ends are usually provided with a hole to facilitate manufacture. Corrosion is prevented by suitable surface protection.

Some corrosion of the heart strand in cables has occurred. Effective lubrication, periodical inspection or the use of clad cable reduces this difficulty.

Cooling coils present a problem of plugging with ice due to the very nature of their installations. An experienced pilot can correct this by closing the shutters when he observes the temperature rising due to a plugged core rather than opening the shutters and freezing up even more.

Ventilation systems, dampers and gates are prone to stick due to ice formation. Doors, sliding windshield panels, and emergency hatches are seriously affected by condensation and freezing. Careful design solves these problems.

Frequently, moisture condenses on the inside of instrument glasses so that the instrument is invisible. In the case of one type of gun sight, fogging of the lens occurred due to moisture absorption in the fiber gaskets of the reticle. Substitution of lead gaskets and baking of the reticle proved a solution.

Corrosion is invited whenever opportunity is presented for trapping moisture. Condensate will collect in regions inside the wing where ribs, stringers, and fillets form natural traps, and with the presence of exhaust gases, a corrosive action is set up. Basic design of eliminating such traps, or providing drainage are the only solutions.

Windshield defrosting, both on the outside and inside, has received considerable attention, but no perfect system of maintaining clear vision is available as yet.

. . . METALLURGICAL Control Acquires New Functions in Forging

by A. J. PEPIN
Wyman-Gordon Co.

▪ **1944 National West Coast Aeronautic Meeting**

(Excerpts from paper entitled "Metallurgical Control of Aircraft Forgings")

METALLURGICAL control in the production of forgings fulfills two functions: first, to maintain quality on existing parts; second, to assure it in new designs which require the development of new forging techniques.

In addition to ordinary metallurgical tests and controls, two new functions which are of particular importance are: (1) the billet magnaflux test which is used to detect flaking in saw and torch cut billet stock by means of magnetic particle testing, and (2) the fracture test, which is used as a check of forging practice.

For these controls to work efficiently, the laboratory departments of our company function accordingly:

Work of the chemistry department consists primarily of routine chemical analysis of incoming raw material. Chemists also check analyses of parts in process, returned forgings, dies, fuels, and so forth, submitted by other laboratory divisions.

The material acceptance department makes the usual acceptance metallurgical tests for aircraft quality steel, including magnaflux cleanliness, grain size, macro-etch, hardenability of both the Jominy and AMS types, and so forth.

The forge shop metallurgist and his assistants are responsible primarily for process control of heating and forging operations and serve as consultants on metallurgical forging problems. Process control of heating for forging includes temperature, rate of heating, time and atmosphere control of forging furnaces. Grain flow checks are made on every new forging before production, and in addition, routine grain flows of all forgings are checked periodically. Also, steel and heat treat specifications are prescribed for tools, dies and hammer parts. Investigations of failures of these parts are conducted and recommendations made for improvements based on the findings of reports.

The tryout Brinell department is situated in the production heat treat. Tryouts from various furnaces are taken at the start of each run and periodically thereafter. Information secured is immediately relayed to the furnace heaters so that changes in furnace temperatures may be made, if necessary.

All forgings processed through the production Brinell department which fail to meet hardness specifications are rechecked by the laboratory salvage Brinell. Forgings which are satisfactory after rebrinelling are returned to production channels. Those running too hard or soft are returned to the production heat treat for redrawing or com-

■ Fig. 1 – Illustrations of various types of fractures

Acceptable Fracture – No Facets	
Yield Point	Tensile Strength
143,500 psi	155,500 psi
Elong. %	Reduction, %
18.5	55.9

Acceptable Fracture – Few Scattered slight facets	
Yield Point	Tensile Strength
142,750 psi	155,250 psi
Elong. %	Reduction, %
17.0	54.6

Unacceptable Coarse Fracture			
Yield Point	Tensile Strength	Elongation %	Reduction %
144,750 psi	156,250 psi	18.5	51.9
Minimum Specification			
115,000 psi	135,000 psi	15.0	50.0

plete reheat treating. Forgings which vary considerably from specifications are scrapped.

Fracture tests are made as part of the final inspection procedure in the fracture test department. This test gives a more sensitive check on forging practice and the Brinell on the forging itself still serves as the indication of tensile properties.

Fig. 1 illustrates sample fractures taken from production fracture test pieces compared with tensile tests cut from the same test pieces. Although the third fracture is considered unacceptable because of grain coarsening, the mechanical properties are still within specifications, and would have been considered satisfactory material by previous standards. Thus, substitution of the fracture test for the tensile test has been a definite overall increase in quality. However, the new user must be cautioned to properly correlate the interpretation of the fracture test with mechanical properties so as to avoid unnecessary rejection of satisfactory material, and to properly design the test piece so that it will be subject to the same conditions of temperature and mechanical work as the forging proper.

One of the essential requirements of aircraft engine and propeller assembly forgings is that they be identified by suitable means as to the heat of steel from which they are made. This is done when the size and shape of the forging permits by means of a stamp impressed in the forging while hot during the trimming operation. All heats of aircraft alloy steels are identified by heat code number. This function is performed by a separate production control department.

One of the most interesting developments in the aircraft forging field is the forging of one-piece propeller hubs with semi-pierced arms. It is important not only because of the tremendous saving in raw material and machining time, but also because it results in a metallurgically improved finished product. Steps in the complete forging procedure on a typical one-piece hub forging follows:

1. Forging multiples are cut from 9 in. round-cornered square 4340 steel billets, and are heated in an oil-fired furnace to an optical temperature on the dies of about 2200 F.

2. In the first forging operation the heated multiple is longitudinally edged in V dies on a 9000 lb steam drop hammer.

3. The second hammer operation consists of rough blocking in an 18,000 lb hammer. The die fills the arms and inboard ring and rough pierces the center bore.

4. The third operation is the finish die hammer operation in an 18,000 lb hammer.

5. The fourth operation consists of trimming the forging flash in a mechanical press, after which the forging blank is given a wash heat to a temperature of about 2150 F.

6. In the fifth operation the solid arms are extruded in a three-way press.

PROPOSE COMFORTABLE COMMODIOUS LUXURY PLANES FOR GLOBAL ROUTES

by HENRY DREYFUSS
Industrial Designer

■ 1944 National West Coast Aeronautic Meeting

(*Excerpts from paper entitled "Fitting People Inside a Machine"*)

As each form of transportation has reached a certain degree of perfection and the exterior form has become accepted, the passenger public's interest in its exterior appearance has diminished – and its interest in interior comforts and luxuries has increased.

Such will be the case of airplanes, with the passenger a demanding customer wanting (and for a low fare) extreme comfort, luxurious surroundings, lounges, bars, smoking rooms, and lobster with champagne at every meal!

Today, when a plan for a new plane is presented to me, my first question is, "Is it to be a sardine can – or may we make it a luxury liner?" I do not mean to be unduly critical. Neither do I want to imply that no compromise is possible, which is to give the public a maximum of comfort and airline officials the capacity they need.

Railroads have gone through this very phase of crowding as many passengers as they could into a train. Straight-backed seats and inadequate leg room, providing only a minimum of comfort, have been supplanted by commodious reclining chairs with comfortable foot rests. They soon learned that proper lounge, dining, and washroom facilities also had to be provided. What I want to see is airplanes of the future starting where railroads *left off*, not where they *began*.

While the designer cannot create cubic inches, his knowledge can contribute to optical illusion by making a small area seem more spacious. Various colors have a tendency to make small spaces appear larger. Combinations of color can make a ceiling seem inches farther away than it actually is. Arrangements of line can also be of assistance in making constricted spaces seem to have larger proportions.

Probably more difficult, but also more rewarding, is the arrangement of masses to give a feeling of greater spaciousness. The psychology of the use of color is another elusive science to be used in the interior of planes. Colors and combinations of them can soothe, irritate, nauseate, or excite the average human. We are aware that yellow must be used sparingly in any means of transportation, as many people surrounded by this color have a tendency to illness.

Saving weight obviously assumes enormous importance. The war has accelerated the development of many lightweight, durable materials – plastics particularly. An extremely comfortable seat has been developed of a vinyl material eliminating rubber, springs, and upholstery, and this saves pounds. There is a fine-looking plastic wall covering, woven porous enough to absorb sound, and also washable. Lightweight plastic insulating materials are already in use. Plastic lenses to be used in lighting fixtures will help maintenance and also concentrate

candlepower at the reading level. A specially backed carpet will weigh as little as 2 oz per sq ft. Curtains for use on berths have been developed that are infinitesimal in weight, opaque, and do not crush.

Polaroid windows, weighing much less than pre-war examples and capable of excluding any degree of light, will do away with those absurd window curtains. Plastic mirrors are procurable, unbreakable, and vastly lighter than their glass counterparts. Of great importance, new materials will permit a whole new system of waste disposal for toilets, which will be a welcome solution to a long-prevailing nuisance.

Taking a swift look into the aeronautical future, I believe airplanes will be large, but I do not believe they will necessarily carry large numbers of people. That is, while there is bound to be an airbus type of travel at a minimum rate with many people crowded into a plane, I can also visualize private staterooms, even suites of rooms – dining salons, card rooms, television, and radio rooms – not as spacious as on an ocean liner, but certainly as luxurious.

Then, of course, there is the compromise – probably the airplane will emerge as the most popular form of air transportation. This will mean producing a plane, which, for a medium fare, will provide sufficient real comfort to attract and satisfy the mass public.

Planes will be used not only for fast travel over land and sea, but also for reasonably leisurely cruises – a couple of weeks around the world with side excursions by helicopter into obscure places.

On some long journeys, it seems feasible to consider a sit-up type of plane flying during daylight and landing at some mid-ocean island at dusk. Such an island, controlled by the airlines, could have a splendid hotel at no extra cost to the traveler, who would have purchased an all-inclusive ticket. Perhaps this might be another type of compromise. Let the planes be crowded with passengers – all payload and just enough fuel to carry the plane to our mid-ocean paradise. There the passenger stays overnight, to be carried on the next morning, his plane refueled and restocked.

One of the details an industrial designer must consider in developing an airplane interior is the stowing of passenger luggage. I have hopes that the airlines and luggage manufacturers will get together and standardize on sizes of luggage.

While an airplane's first function is to give fine performance as a flying machine, its second function is to allow passengers to be placed within that machine. That is the reason for its existence.

Flight Deck Operations Require Detailed Script

by RALPH S. JOHNSON
United Air Lines

▪ **1944 National West Coast Aeronautic Meeting**

(Excerpts from paper entitled "Coordination of Flight Deck Duties on Large Airplanes")

EXPERIMENTAL study of the problem of coordinating flight deck operations indicates that two essentials are required for an adequate solution. First, a well-planned operational script is necessary; second, an instrument containing the operational script which is permanently mounted in the airplane.

The following steps may be an aid in the preparation of an adequate flight deck operational script:

1. List all groups of operations, such as entering the airplane, starting engines, before taxiing check engine run-up, take-off, climb, cruising, and so forth.

2. Under each group heading, list all of the operations pertaining thereto without attempting to place them in order. Include all essential information required for the proper operation of the airplane, such as power settings, airspeed for take-off, and climb.

3. Rearrange each item in the group so that sequences on the flight deck are in simple continuous paths of movement. After the paths have been learned, the crew will not need to read each step. The script will then serve as a reference and as a means of maintaining coordination of the work of the flight officers.

4. Rearrange the wording for each item so that the name of the control or instrument will be the first word in the line.

5. Divide the work of the two flight officers on duty.

6. Prepare an emergency procedures section, which will include every emergency procedure which could be useful to the pilot. This insures that the remedies learned by experience and analysis will continue to be handed down to the flight crews and will be instantly available to them.

The operational script must be conveniently visible at all times, and this points to the need for an instrument containing the script which will be permanently installed on the flight deck. This is the coordinator, the second essential for flight deck coordination. This instrument is located between the two pilots for close visibility, and is constructed with a light inside of it to provide for illumination at night. The operational script may be read through a window constructed in the face of the instrument, while two rollers at the ends of it provide the means of moving the script across the window, making selection of any group of operations an easy matter. The following examples illustrate how improvements in flight can be expected by equipping all large airplanes with the flight deck coordinator:

(1). During the descent to a landing many scripts provide a single group of flight deck operations. A single group cannot accommodate this operation because three distinct stages of flight are being passed through during this descent. A script designed to accommodate the three stages, namely, cruising, maneuvering and landing descent is recommended. The time specified for execution of the group is printed beneath the title of each group, and provides for deliberation in the performance of duties. This planning eliminates the possibility of flight deck operations being delayed in their execution until late in the descent, which would induce haste and neglect of duties.

(2). By use of a coordinated engine run-up group the average time required to perform the run-up was decreased from 9 min to an average of 2½ min.

(3). Tests were made simulating the failure of one engine. It was found that the flight officer, when using his own method, required from 4 to 8 min before all of the items considered necessary for one-engine-out flight had been completed. When he employed the coordinator path for accomplishment of one-engine-out operations, time required to complete the flight was 45 sec.

During the past two and one-half years four flight test crews at United Air Lines Cheyenne Base have flight-tested more than 5000 heavy bombers and airline transport airplanes without an incident. A complete change of flight personnel occurred on the average of every 11 months, which presented an excellent opportunity for the testing of the flight deck coordinator and its script. The result was that all the crews appeared to operate the airplanes in an identical manner, the coordinator and its script contributing principally to this accomplishment.

. . . WIND TUNNEL Tests Preview Traits Of Plane Designs

by R. H. WIDMER
Consolidated Vultee Aircraft Corp.

▪ **Texas, Aug. 18**

(Excerpts from paper entitled "Designing a Modern Heavy Bomber Through Wind Tunnel Testing")

THE purposes of running extensive tunnel tests are: (1) To improve airplane performance by decreasing its drag or air resistance, and to justify allowances made for future improvements at the time of original study; (2) to assume satisfactory flying qualities; and (3) to obtain air loads necessary for efficient structural design of the airplane.

In order to accomplish the above, nine wind tunnel tests are necessary. Three of these are complete model tests, namely, (1) small-scale low-speed power-off model; (2) large-scale model with power-on or running propellers; and (3) high-speed tunnel model. There are also detail model breakdown tests, which are (1) two-dimensional wing airfoil sections; (2) two-dimensional wing airfoil-flap sections; (3) small-scale nacelle model; (4) semi-span wing aileron and flap model; (5) semi-span tail model; and (6) full-scale nacelle powerplant installation.

It is necessary first to obtain a quick

check on the overall aerodynamic characteristics of our design, and this can be best accomplished by a small scale power-off model test. With this overall picture, it is possible to start some of the detail model breakdown tests. The first is to select the optimum airfoil sections for the wing. The airfoil test is run in a two-dimensional flow wind tunnel, which means that all lines of flow over the wing are chordwise and there is no spanwise flow. In order to obtain this type of flow, the model is mounted in the tunnel so that the wing completely spans the tunnel and is of rectangular planform with a constant airfoil section along the span.

After the definite airfoil section has been selected for the wing, there should be another two-dimensional flow test to determine the optimum type of wing flap and flap path for the airplane, and to determine flap air loads. This test is run in the same tunnel as the airfoil tests.

With the completion of these tests, the airplane wing is definitely determined and should be incorporated on the small complete power-off model for another check of the overall airplane aerodynamic characteristics. This model will probably include a new tail and a new set of nacelle lines. At this time, a study of the nacelle drag should be started to obtain the optimum external nacelle lines and internal duct lines for minimum losses. A relatively small-scale model of wood construction should be used for this test to facilitate changes during the testing.

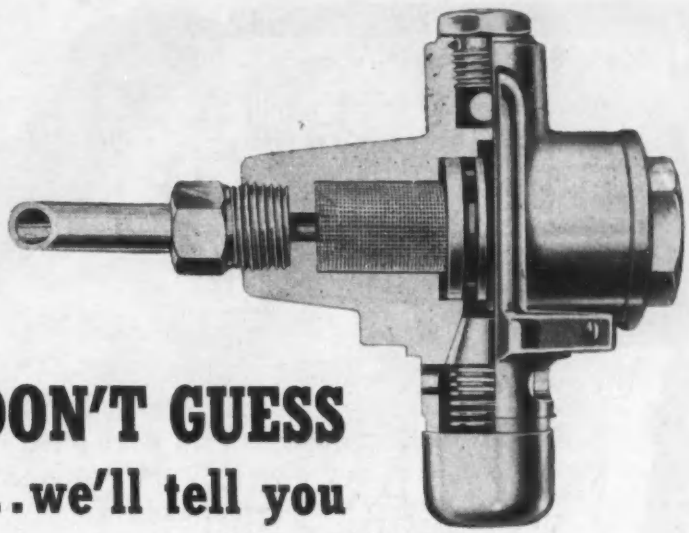
Test procedure used in analyzing the nacelle drag involves the setting of various flow conditions in each of the ducts to simulate actual flight conditions on the airplane. The total nacelle drag can either be measured by force tests or by wake surveys, and duct losses are measured by total head pressure drop losses. The type of wind tunnel best suited for such a test would be most any low-speed tunnel where operating cost is low, since such a test can last as long as a year if a completely thorough job is to be done.

The next step should be a preliminary check on the effect of compressibility on the overall airplane aerodynamic characteristics. Compressibility is a sort of piling up of air particles flowing over a body, and when the critical speed, or the speed at which the local velocity of air reaches the speed of sound is obtained, pulsating shock waves begin to emerge from the body. This results in an increase in drag and decrease in lift in the case of an airplane wing. There are four tunnels available for such type of tests in this country; three are at NACA and the fourth belongs to the Air Technical Service Command at Wright Field. The largest of the high-speed NACA tunnels has a 16-ft diameter working section, and is capable of speeds up to 600 mph. The power necessary to drive the wind tunnel fan is 27,000 hp. The tunnel at Wright Field has a 20-ft diameter working section, and is driven by a 40,000 hp power unit. The type of models used for these tests must be sufficiently strong to withstand a tunnel q (dynamic pressure) up to 700 lb per sq ft, which means about 3000 lb of absolute lift.

About this time a complete powerplant check should be made in a wind tunnel, since a few actual test engines will probably be available. The purposes of such a full-scale nacelle test are to obtain full-scale duct losses and velocity distributions in each duct; to obtain engine cooling data which includes quantity airflows and required pressure drops; to obtain fuel consumption data; and to eliminate engine operating bugs. The nacelle for this type of test is usually mounted on a stub wing and due to its size can only be tested in tunnels with working sections greater than 16 ft in diameter.

A detail study of the control surfaces should now be made, and the first of these should be of the ailerons in case it is found necessary to revise the wing structure to accommodate a change of design. The best method for obtaining accurate lateral control characteristics is to test a model consisting of a semi-span wing. Three important aerodynamic characteristics can be obtained from this model, which is cantilever mounted to one of the tunnel walls. The first is that of aileron hinge moments for estimating control forces and aileron effectiveness. The second is to check the wing flap effectiveness on a complete large wing. The third are the wing stalling characteristics.

In order to get an accurate overall picture of the complete airplane before it flies, it is necessary to build a large complete model equipped with running propellers and all remotely controlled control surfaces. The purpose of this is to obtain the following: (1) airplane stability and control characteristics with both power on and off; (2) all



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control surface hinge moments, and thereby airplane control forces; (3) accurate drag breakdown of the component parts of the airplane; (4) effect of ground on landing and take-off control; and (5) wake survey and flow measurements in the tail plane for all flight conditions.

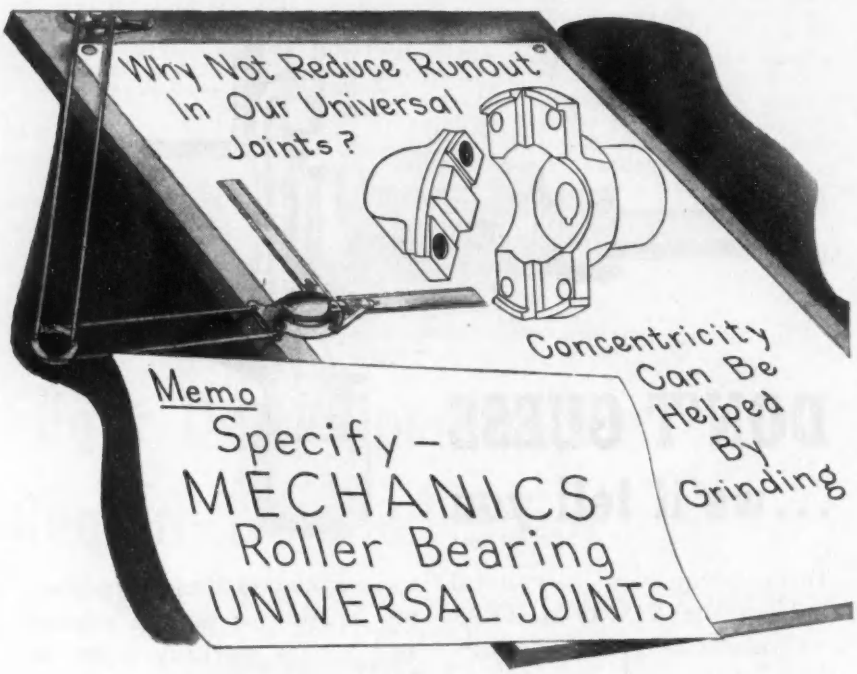
This model is usually tested in as large a tunnel as possible, and at present the most suitable in this country is the 19-ft pressure tunnel at Langley Field.

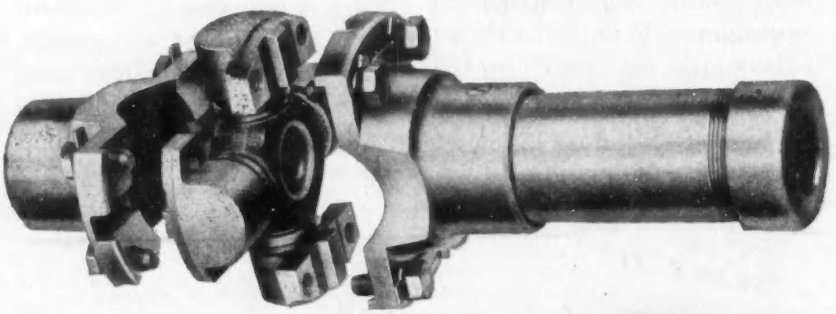
Detail empennage tests are scheduled last, since they require the least amount of time to redesign compared to other major components of the airplane. The model used for this test is a semi-span tail which is cantilever mounted from the tunnel wall or floor, and the test can be made in a relatively low-speed tunnel.

The last tunnel test necessary is also a check of tail control forces and requires the use of a high-speed tunnel model. The purpose of this is to determine the effect of compressibility on the control surface hinge moments.

This problem has only arisen within the last year on airplanes, because up to then their operating speeds and altitudes were not sufficiently high to run into serious control force problems.

With the completion of the high-speed wind tunnel test our tunnel program is finished, and the only thing that is left to be done is to wait for the actual flight test results on the first airplane.





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. . . . AIR TRANSPORT Operations by Military Reach Tremendous Scales

by COL. HAROLD R. HARRIS
Chief of Staff,
Air Transport Command

▪ Metropolitan, Sept. 14

(Excerpts from paper entitled "History and Development of the Air Transport Command")

THE Air Transport Command is little more than three years old, yet it has become the biggest and farthest-reaching air transportation system the world has ever seen.

As presently organized, the ATC, originally called the Ferrying Command, includes two operating divisions – ferrying and domestic transportation. In addition to being responsible for ferrying all aircraft within the boundaries of the United States and abroad, the ATC now transports personnel, materiel and mail for all War Department agencies, except those served by troop carrier units, and is responsible for the control, operation and maintenance of establishments and facilities on air routes outside the United States which are within the jurisdiction of the commanding general of the Army Air Forces.

All Terrain Flown

ATC pilots fly over every kind of terrain, from mountains and Arctic wastelands to tropical jungles and oceans, encountering all sorts of weather conditions. Better pilots, better planes, better communications, all contribute to a day and night, almost weatherproof operation.

Air freight hauling on a grand scale is a reality. ATC ships carry units as heavy as a fully-assembled airplane engine. Boxes of tungsten and mica run into weights totaling hundreds of pounds. Comparing the airplane with the ocean vessel as an international cargo carrier, the Office of War Information disclosed that 15 million long tons of cargo were carried by ocean-going vessels during the first six months of 1944. In the same period airplanes – and the ATC was the principal carrier – carried 22 million lb of cargo, or only 66 thousandths of 1% of the total volume by ocean vessels.

Cargoes carried by ocean vessels had a total value of $1,230,000,000; those by airplane, $79,000,000, or 6.42% of the total value of ocean cargo. Thus, in terms of average unit value the cargoes carried by ocean vessels amounted to 3.6¢ per lb, while the average unit value of cargoes carried by air was $3.58 per lb – 99 times as great.

The ATC cargo fleet necessarily includes several types of aircraft; the principal ones are the C-47 Skytrain, the C-46 Commando, the C-54 Skymaster and C-87, commercial

version of the B-24 Liberator bomber. These planes make long and short hops from long and short runways. They fly in high temperatures and in low temperatures, at high altitudes and at sea level. So far, it has been impossible to completely standardize ATC aircraft, even on individual routes, because of these variables.

Engineering developments along several lines, however, have influenced and have resulted from ATC operations. Developments directly affecting aircraft operation, which are of primary importance, range from major modifications, like installing additional gasoline capacity, to minor changes in the arrangement of crew compartments. Many improvements have been made in the engines, airframes and accessories of aircraft operated by the Command. Solid improvements have also been made in communications equipment, and a worldwide network of communications facilities has been established.

Maintenance is Biggest Task

Airplane maintenance is our biggest problem. ATC flight engineers long have been doing the impossible in meeting emergency situations. By cannibalizing damaged bombers and fighter planes at the war fronts, they have kept many a transport moving along its route when lack of ingenuity would have meant a grounded aircraft.

There was a time when it was necessary to remove the cowling on a C-46 to get to the rear spark plugs, an operation requiring several hours. An ATC maintenance crew in the India-China Division cut an inspection door in the cowling and it now takes a few minutes to inspect the rear plugs and, if necessary, change them.

There was another time when the rear tire on a C-46 was good for an average of only a dozen landings on the kind of strips ATC planes have to use at many overseas bases. After a series of experiments, maintenance experts changed to a tire with a greater surface tread and arrived at a combination of tire and shock strut air pressure that now make the rear tire on a C-46 good for an average of 40 landings. Similarly, far greater service was developed on tires of the C-87 by raising the air pressure from 56 to 75 lb.

The ATC has accidents, but percentagewise the facts are most reassuring. In the first seven months of this year, excluding the operation between India and China where enemy action has a material effect upon aircraft losses, we have flown about 600,000 hr. During this time our fatalities per million passenger miles have averaged .12; in other words, one person killed every 8,000,000 passenger miles flown in these Air Transport Command operations.

The utilization of great quantities of air transport aircraft is reasonable if the transport market is extended. I submit the need for a new transport design, the design limitations to be: 1000-mile range, 25% reserve, a cruising speed of 200 mph, assured stability, a minimum of cabin luxury, less than 3¢ per passenger mile overall costs, plenty of cubic area available for passengers and cargo, elimination of cabin supercharging, no berths, and maximum ease and simplification of maintenance.

The number of engines in this new airplane would depend largely on the effect that the Civil Aeronautics Administration regulations would have on performance. It is hoped that a reroading of existing regulations can be taken based on ATC experiences throughout the world with the present well-known types.

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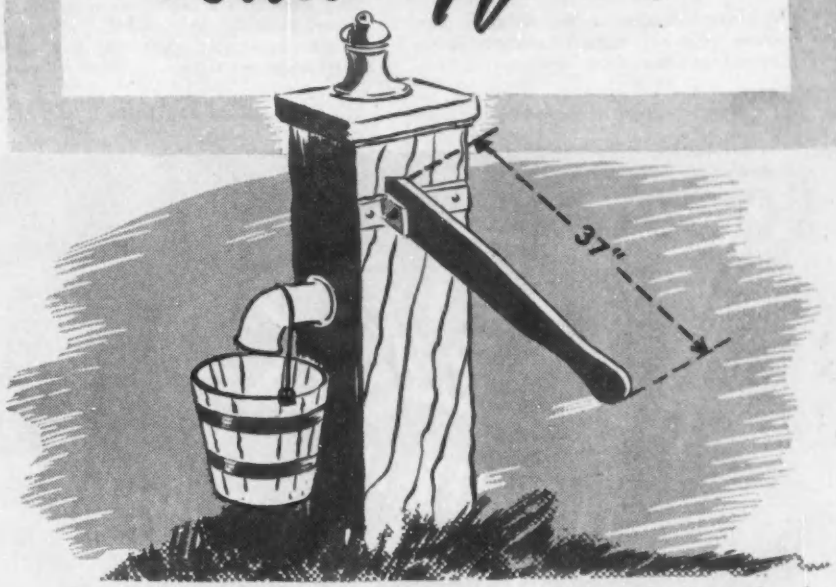

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COMFORT Analyzed

by ALBERT A. ARNHYM
Solar Aircraft Co.

▪ San Diego Group, Oct. 17

(Excerpts from paper entitled "Comfort Requirements of Military Aircraft")

IN providing comfort for military flight crews, it is only negative comfort, or the elimination of something that causes discomfort, which has to be considered. For instance, a high-altitude flyer is provided with oxygen equipment because its lack would result in serious discomfort or even death. This differs from positive comfort, which adds something desirable but not essential, and the lack of which is without physical consequences.

The first prerequisite in providing the optimum amount of comfort for a military flight crew at the least price is for all concerned with the design of the airplane and its accessories to be fully cognizant of the importance and scope of comfort requirements. Next, it is necessary for all groups to collaborate closely with the comfort group so as to prevent the need for crowding comfort devices into the airplane after it is all but finished.

The following is a list of comfort features for military flight crews: (1) air supply; (2) heating; (3) fighting comfort; (4) seating and resting; (5) soundproofing; (6) lighting; (7) food; (8) lavatory facilities; (9) ease of motion.

The requirement of air supply concerns not only oxygen equipment for high-altitude flight, but also the provision of sufficient air flow and pressure to satisfy the demands of the human body. This entails such problems as the need for removing sickening odors, keeping the percentage of carbon dioxide and monoxide in the air below safe limits, supplying enough air for breathing without causing drafts or foul air pockets, preventing aero-embolism as a result of insufficient air pressure, and providing cooling. In addition, the air has to serve, in many installations, as the carrier and distributor of heat. Unless the equipment for air supply is considered while the rest of the design is still flexible, it will be inefficient, heavy, and unsatisfactory.

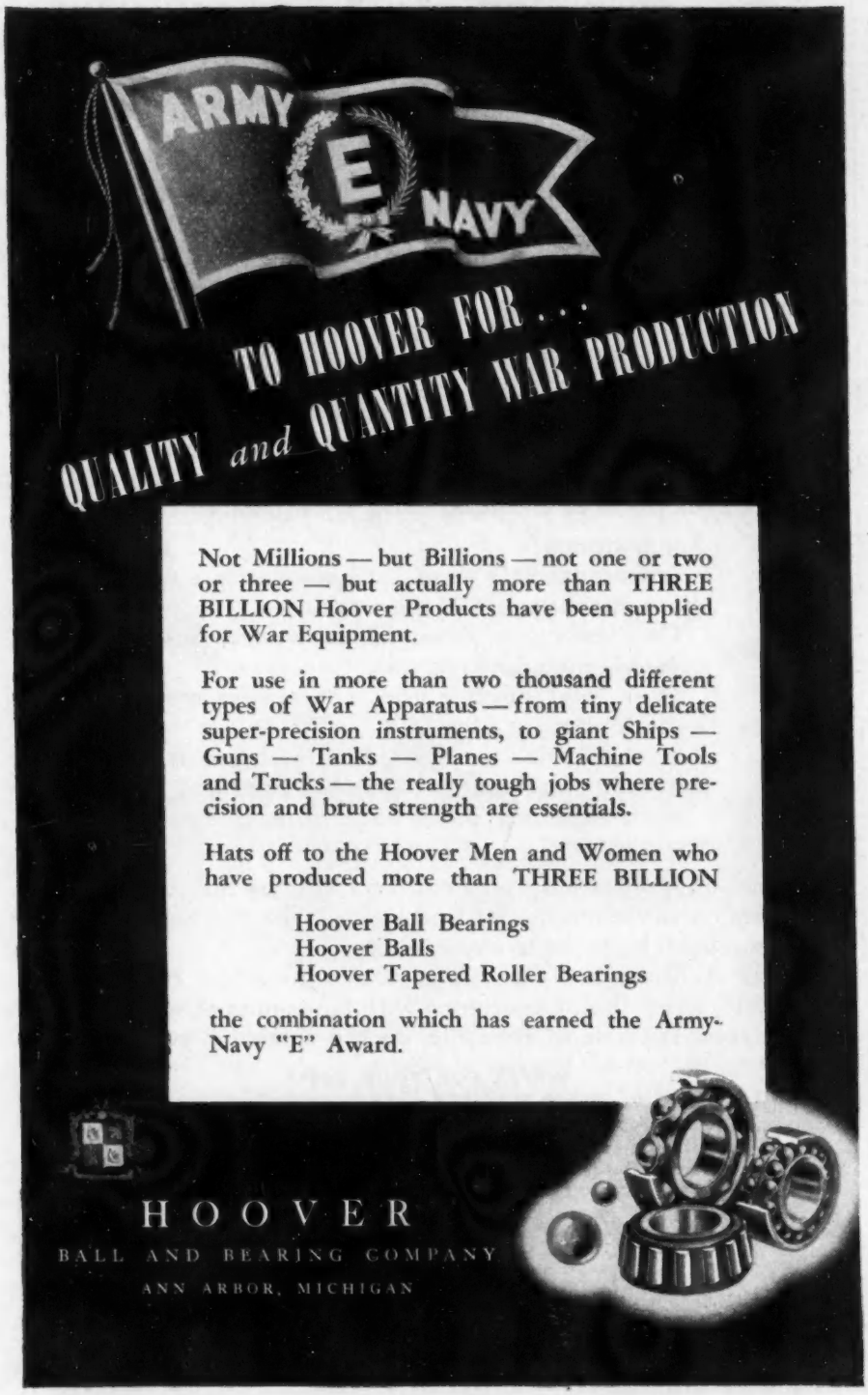
A few years ago, heating of military airplanes was not considered important enough to sacrifice any weight, space, and electric current for it. Only after British flyers actually froze to death in spite of the heaviest flight gear, cabin and cockpit heaters were conceded to be indispensable accessories. Since then, the scope of heating has multiplied many times and added dozens of other functions, as heating of instruments, gun breeches, wings and control surfaces, air induction system, windshields, propellers, batteries, and many others.

Fighting comfort, the next item, comprises equipment for assisting the flight crews in overcoming the effects or after-effects of combat. It includes everything needed to get a flyer who bails out from a disabled plane back to his base. This covers provisions to facilitate the jump under any conditions; parachutes, life rafts, signaling equipment, and so forth. In addition, there are fire-fighting equipment, first-aid supplies and devices, protective armoring, proper flight gear, and such apparently insignificant details as rubber rings around eye-pieces of sights to prevent injury to the eye in sudden flight evolutions. In the same class fall provisions for rapid recovery from blackouts during dive-bombing.

Seating and resting are of the greatest importance because seating fatigue is a more serious handicap than most people realize. Manufacturers have provided push-button controls to move seats in any number of ways to make them especially suited for the particular task of the occupant. However, location of a chair, illumination, proximity to working area, and other features are entirely the responsibility of the airframe designer.

Noise is one of the most serious causes of discomfort and rapidly increasing fatigue. Soundproofing at minimum weight requires the closest attention of every contributing designer, and considerations of lighting such as good visibility, proper illumination and design of optical equipment are of equal importance. Provision of well-balanced and selected food is another aid, as is the design of suitable lavatory facilities.

Quick motion in and out of seats and between battle stations on a bomber is of the utmost importance also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Instrument Accessory DESIGN

by W. A. REICHEL
Eclipse-Pioneer Division
Bendix Aviation Corp.

• 1944 National West Coast Aeronautic Meeting

(Excerpts from paper entitled "War Lessons in Design of Accessories and Instruments")

WAR experiences, combined with the necessity for high-altitude performance, have given us some answers to several vexing questions about the design of accessories and instruments.

Before the war, in accessories and instruments, Britain was thinking hydraulically, Germany electrically, and we were somewhere in between. The first war months clearly showed the vulnerability of the hydraulic system to gunfire. Maintenance and service problems also proved more burdensome. Cold weather and high-altitude operation indicated that the electric system was preferable.

Another question was whether an AC or a DC system was better. In order to eliminate brush troubles, alternating rather than direct current was our choice, throughout our systems, as a power source. Under operating conditions in almost every climate in the world, these designs were tested. Service and combat experience definitely proved DC motors and mechanisms to be vulnerable owing to commutators and brushes. Brushes required servicing and commutators needed to be cleaned. As a result of design improvements, there is every probability of even wider use of AC systems in the airplane of the future.

To prevent failure caused by dust, corrosion, moisture, condensation, high altitude and other such conditions, serious consideration is now being given to sealing critical units in a glass or metal envelope. This is now being tried with switches, relays, gyros and even with inverters.

Sealing in dry inert gas creates an almost ideal condition for the operation of such equipment. It assures operation under normal atmospheric pressure at all times.

War has given us and tested for us many new materials. Examples of this are the growing uses of magnesium, permalloy, alnico, and beryllium copper. Without permalloy and alnico the Magnesyn and Gyro Flux Gate Compass probably could not have been made to work. Beryllium copper has given us excellent diaphragms.

One of the most important lessons we have learned, however, is that in the accessory and instrument field we must not favor one way rather than another in accomplishing the desired result. For example, where longitudinal motion of a device is required, a hydraulic cylinder and piston may be preferable to an electric actuator, particularly if long piping is eliminated by using an electric motor to operate the hydraulic pump close to the actuating cylinder.

But the chief lesson we have learned as a result of the war is the saving of time in designing an instrument or even a system. It was necessary to divide our engineers into groups, each headed by a senior engineer, each senior engineer having several project engineers assigned to him. The project engineer's responsibility is now to design, develop, test and release an instrument or device to production.

He starts with a problem given to him, conceives the design, develops it in accordance with specifications by the customer whom he contacted, puts the design through designing and testing, and then, when the order is received, works very closely with tool design, seeing that all production difficulties are taken care of. Inspection, which reports to the engineering department, checks that products are in strict accordance with specifications and drawings. The first installation in the field is often made by the project engineer, so any difficulties occurring are reported to him. As soon as routine manufacturing begins to take more of the load, the project engineer starts to develop an improved model, incorporating in it what was learned from its production and field application.

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About SAE Members

Cont. from p. 33

abroad. An organizer and vice-president of the Ethyl Gasoline Corp. and later Kinetic Chemicals, Inc., he was also vice-president of the Ethyl-Dow Chemical Co.

Upon graduation from Cornell in 1911, he engaged in research work at the National Cash Register Co. and later joined SAE Past President Charles F. Kettering with the Delco Light Co., both at Dayton. He then became superintendent of the Midgley Tire & Rubber Co., Lancaster, Ohio, founded by his late father, a manufacturing executive and also an inventor. He joined General Motors Corp. in 1920, and later was elected vice-president of General Motors Research Corp.

An SAE member since 1918, the following papers were written and presented by Dr. Midgley before the Society:

"Antiknock Fuel Research"; "Antiknock Fuels"; "Combustion of Fuels in the Internal-Combustion Engine"; "Detonation Characteristics of Some Blended Motor Fuels"; "Ethylized Gasoline"; "High-Speed Indicators"; "Internal-Combustion Engine Radiation Characteristics"; "Latest Developments in the Fuel Situation"; "Laws Governing Gaseous Detonation"; "Liquid Fuel Reserves"; "Methods of Measuring Detonation in Engines"; "Molecular Movements During Combustion in Closed Systems"; "The Pressure-Volume-Quantity Indicator Card"; "Radiation Characteristics of the Internal-Combustion Engine," and "Spectroscopic Investigation of Internal Combustion."

Dr. Carl Claus

Dr. Carl Claus, 60, died suddenly Oct. 5 of a heart attack. One of the first engineers to carry on sustained research in the art of powder metallurgy, and a leading authority on the subject, Dr. Claus was vice-president in charge of research with Bound Brook Oil-Less Bearing Co. at the time of his death. He had been employed there for 23 years.

Born in Germany, Dr. Claus was graduated from the University of Berlin, where he received his Doctor of Engineering degree. He became a citizen of the United States in 1921, and seven years later became a member of the SAE.

Joseph J. Federkiel

Joseph J. Federkiel, president of J. C. Ulmer Co., manufacturers of tools, jigs and fixtures, died recently at the age of 55. He had been associated with the company in the same capacity since 1922, before which he had been general manager for Hitchcock Tool & Die Co., foreman for Vim Motor Co., and apprentice at Warren Electric Co., all located in Ohio.

Clarence B. Swift

Clarence B. Swift died July 8 at the age of 54. Since graduating from Harvard College in 1914, Mr. Swift had been in close touch with the automotive industry in executive capacities, and at the time of his death was owner of Swift Mfg. Co., consulting with automotive engineers on radiator cooling fans, as well as secretary and treasurer of Ultra-Lap Machine Co. His first executive-engineering job was president of Cope-Swift Co., later reorganized as Swift Mfg. Co.

Eugene Karl Schultz

Eugene Karl Schultz was killed in the Southwest Pacific War Area May 4, where he was serving as a lieutenant colonel in the U. S. Marine Corps. He was 38 years old. Immediately upon his graduation from Tulane University in 1930, Col. Schultz joined New Orleans Public Service, Inc., as an engineer, and then became assistant superintendent of automotive equipment, the post he held until entering the service.

Theodore H. Marburg

Theodore H. Marburg, president of Marburg Bros., Inc. since 1910, died recently at the age of 71. A native of Germany, he received his early commercial and technical experience in that country, continuing his work in machine tool building and exporting in New York City firms after coming to the United States. Before forming his own company, he had been associated with Garvin Machine Co. and later with Schuchardt & Schutte for 10 years.

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Walter F. Kimball

Walter F. Kimball, president of N. Y. & N. J. Lubricating Co., died recently. He was 69 years old. He served with the company in administrative and advisory capacities since 1898, and was an expert in the selection of lubrications for, and their adaptation to, specific mechanical conditions.

Joseph P. McCarthy

Joseph P. McCarthy, 57, secretary of C & C Sales Co., exporters and importers as well as manufacturers' representatives of automotive and steel products, died recently. His career started in 1915 as supervisor of materials for Chevrolet Motor Co., and he left there six years later to join Durant Motors, Inc., as production manager. Mr. McCarthy served for a short time after that with Crystal Oil Burner Corp., and Continental Motors Corp., before going to C & C Sales in 1934.

Leo New

Leo New, who was superintendent of transportation for United Gas Pipe Line Co. since 1929, died Sept. 2 at the age of 54. From 1909-1918 Mr. New was employed as a mechanic for Packard Motor Car Co. and Blackburn System, and then he was promoted to vice-president and general manager of the latter organization. He remained there until 1924 when he joined San Marcos Motor Co., serving as president for the next five years.

John E. Wilson

John E. Wilson, 43, was killed as the result of an automobile accident Oct. 24. He had just joined United Steel Corp., Ltd., in Toronto, as sales engineer. Mr. Wilson was active in engineering work for the past 24 years, the first six of which he spent as a draftsman, and the following years in sales managing and engineering posts for various steel companies in Canada. He was a native of England.

Donald D. Ormsby

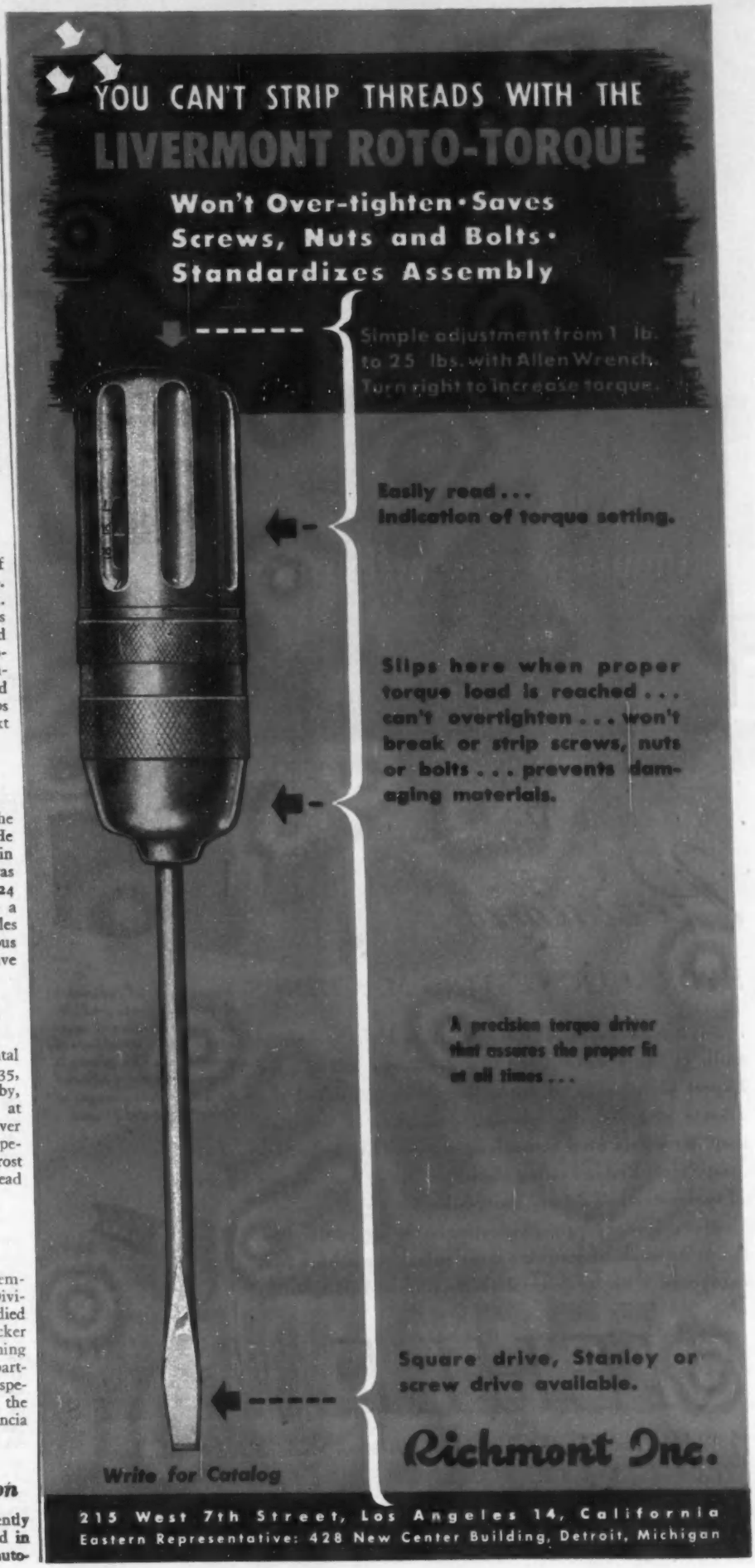
Donald D. Ormsby, gear and experimental engineer, Clark Equipment Co. since 1935, died June 1 at the age of 57. Mr. Ormsby, who studied mechanical engineering at Syracuse University, had been affiliated over a period of 29 years with Brown-Lipe-Chapin Co., Eaton Mfg. Co., and Frost Gear & Forge Division, respectively, as head of design and plant operations.

Anthony M. Flocker

Anthony M. Flocker, who had been employed in the Engineering Production Division, Paragon Paint & Varnish Corp., died recently. He was 60 years old. Mr. Flocker was born in Italy, and received his training as a technician in the motor testing department of Fiat in that country. He was special representative of Fiat for 15 years in the United States, after which he joined Lancia Motors Sales Corp. as general manager.

Dr. Miller Reese Hutchison

Dr. Miller Reese Hutchison died recently at the age of 68. He had been engaged in the design and study of commercial auto-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mobiles since 1904, and maintained his own laboratories in New York City until two years ago, when he devoted his entire time to Government service as a member of the Naval Consulting Board. He was honored various times during his lifetime for his inventions; once by the King of England in 1902 for perfecting the "Acousticon" to enable the deaf to hear, and the "Massacon" for relief of deafness, and again at the St. Louis World's Fair in 1904 for an exhibit of his inventions.

CHARLES KENNETH HUNT has joined American Brakeblok Division, Detroit, as service engineer. He had been with Universal Auto Parts, Albany, N. Y., in a similar capacity.

JAMES W. LEWIS is no longer connected with Sikorsky Aircraft, Division United Aircraft Corp., Bridgeport, Conn., as chief checker, as he is now attending the College of Engineering at the University of Michigan.

R. A. JEHEBER, formerly director of research, Mack Mfg. Corp., Plainfield, N. J., is now associated with Lawrance Aeronautical Corp., Linden, N. J., in an engineering capacity.

LUDWIG HENIG has been named vice-president and general manager, Michael Gregor & Associates, New York City. He was formerly president of G. M. & L. Henig Corp., same city.

Formerly tool designer, Packard Motor Car Co., Detroit, **T. W. HOOVER** is now an instructor in tool design, Wilbur-Wright Vocational School, same city.

JOHN W. HORNER, formerly development engineer, Aerojet Engineering Corp., Pasadena, Calif., is now employed as an engineer, Righter Mfg. Co., Burbank, Calif.

PUTNAM S. HUSTON, who had been director of planning, Lawrance Aeronautical Corp., Linden, N. J., is now doing production control work at Watson-Flagg Machine Co., Paterson, N. J.

RICHARD S. HUESTED has been appointed manager of Curtiss-Wright Corp.'s Washington office. He had been manager of public relations, Wright Aeronautical Corp., Paterson, N. J.

ALEXANDER W. HOSIE, formerly motor vehicle and machine inspector foreman, John Ingles & Co., Ordnance Division, Toronto, Ont., is now service manager, General Motors Products, same city.

CAPT. CHARLES MOHNEN, U. S. Army Air Forces, has been transferred from Denver, Colo., to Air Technical Service Command, Newark, N. J.

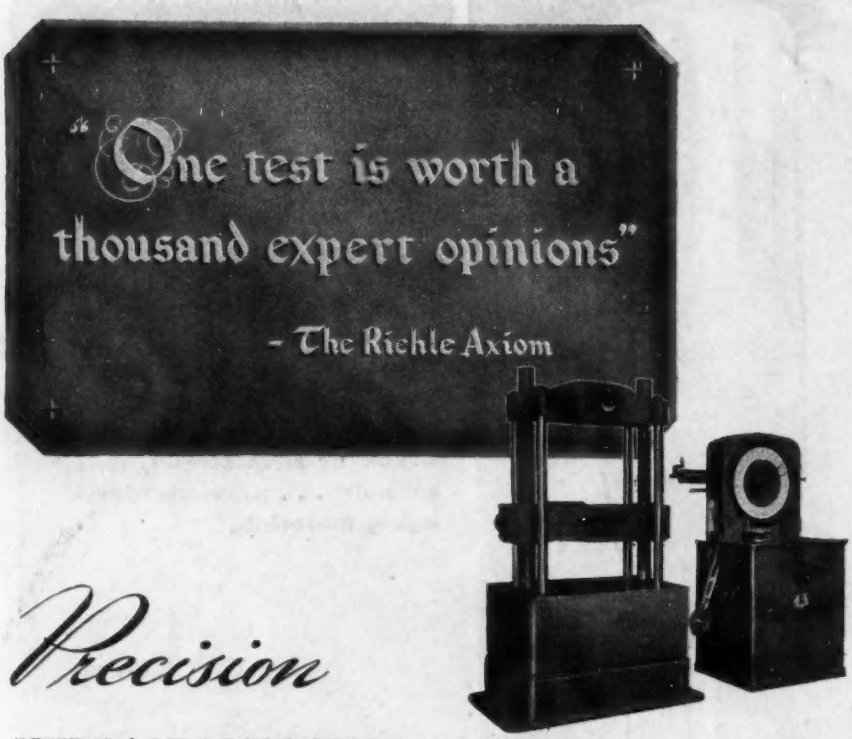
KARL BROCKEN has resigned as vice-president of G. McStay Jackson Co., Inc., Chicago, and has formed his own industrial design organization in Milwaukee.

ENSIGN RICHARD J. KOERWER, U. S. Navy, may be reached at the Naval Air Station, Alameda, Calif. He was formerly test engineer, Wright Aeronautical Corp., Paterson, N. J.

JOSEPH GESCHELIN, Detroit editor, Chilton Publications, will address the SAE Syracuse Section and Syracuse Technology Club on "Post-war Developments and Reconversion Problems in the Automotive Industry" on Dec. 11.

Previously development engineer, B. F. Goodrich Co., Akron, Ohio, **FRED L. HAUSHALTER** is now connected with the Office of the Chief of Ordnance – Detroit, as rubber consultant. Mr. Haushalter is a past vice-chairman of the SAE Cleveland Section.

A. L. BERGER, formerly mechanical engineer, USAAF, Wright Field, Dayton, Ohio, is now associated with A. L. Berger, same city, in a similar capacity.



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APPLICATIONS Received

The applications for membership received between Oct. 10, 1944, and Nov. 10, 1944, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Baltimore Section: Lt.-Col. William C. Farmer, G. Bernard Fenwick, Jr., J. R. Gourley, Lawrence V. May.

Buffalo Section: Valentine D. Kauth, Bernard E. O'Connor.

Canadian Section: Charles M. Birkett, James Stuart Johnston.

Chicago Section: Erich O. Adomeit, J. F. Austin, T. Homer Bachmann, Scott B. Barnhardt, Henry H. Dulkin, Charles P. Graddick, Donald S. Gray, Sam A. Ladd, Andy Lenz, Jr., John P. Lichter, Henry A. Mossman, Henry Y. Ruby, Oswald L. Sarazin, Rudolph E. Vetren, Lowell R. Whitla.

Cincinnati Section: O. Thomas Pfefferkorn.

Cleveland Section: G. Mervin Ault, William L. Bevan, Melvin Seymour Feder, John W. Frazier, Glen Goodwin, George W. Hobson, William Charles Hochstetler, Robert Charles Lieblein, Sam R. Llewellyn, S. V. Manson, Rodney O. McSherry, Alexander Mendelson, Theodore J. Nussdorfer, Jr., Benjamin E. Nye, Gerard A. Parseghian, Charles L. Paxton, Joseph S. Pollack, Philip F. Scofield, H. Maynard Snow, Thomas R. Spalding, Lorain Norton Vandervoort, William Glen Waltermire, Paul I. Wilterdink.

Colorado Group: K. E. Goss.

Detroit Section: Milton S. Bald, Frank Brandt, Robert W. Burton, Edwin Trenner Campbell, Charles J. Cook, Lewis P. Favorite, Ronald A. Gatenby, Erwin L. Gehrke, Edward Martin Gelman, William L. Hovis, Thomas N. Kelly, Theodore F. Lapinski, Lawrence J. Lief, George Wallace Matthews, Clarence M. McDowell, Thad McRae, A. Alan Montrose, J. Nall Candler, Wilbur D. Osborne, Peter Herget Ponta, E. Merideth Roberts, Jr., M. S. Rosenberger, Edwin S. Ross, Elmer J. Selter, Joseph Carman Shenstone, J. Raymond Stevenson, Alfred E. Stocker, James Edward Stockton, Ralph E. Van Deventer, Wilfred Williams, Ernest R. Wonders.

Indiana Section: Calvin C. Chang, Joseph H. Clark, Emory N. Kemler, Otto L. Kraft, Whitten L. Lingeman, Harry L. Stewart.

Kansas City Section: August Bartsch, Capt. Harry L. Braun, Allan C. Redden, Howard W. Tipton, Byron L. Weiss.

Metropolitan Section: Robert M. Barth, Albert K. Baum, Graham H. Bell, Emil V. Belsky, Robert Joseph Bigley, Charles Norman Carlstrom, Sydney Thomas Clifford, Enver Eke, Jules B. Esser, Erich O. Fietsch, Charles J. Firmbach, Dr. John O. Forster, Dudley D. Fuller, C. H. Glasier, Jr., Irving F. Koetting, Paul A. Koorbanoff, Donald Bruce Lane, Kenneth M. Magee, Jean William McComas, Jack C. Maillard, John Francis McEnerney, Timothy S. McGlynn, Leonard H. McPeek, John Christian Meister, David S. Milligan, Robert H. Penner, Lt. (j.g.) William S. Prial, Louis John Schmidt, Grant Elbert Scott, Jr., Frank J. Smith, Adolph Sokol, Edward Karl Sundstrom, A. Thellemann, Kurt H. Weil.

Mid-Continent Section: Capt. Robert O. Benecke, William Kenneth Randall, O. M. Setrum, John H. Turner.

Milwaukee Section: William Charles Benson, John W. Henderson, Howard A. Hoffman, Earle F. Rueter, Karl P. Schoeppner, Noble Sherwood.

Mohawk-Hudson Group: Lloyd C. Bower, Edward S. Hoke.

New England Section: Thomas F.

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Kinahan, Lt.-Col. G. E. Ledbetter, F. Clayton Meserve, Robert William Nielsen, George A. Smith.

Northern California Section: Lt. Peter I. Brown, Glen D. Grant, Earl Edward R. Jones, Stanley S. Sorem, Sheldon Paul Stein, 1st Lt. Eugene A. Peterson.

Northwest Section: William A. Alexander, Wilbur Ward Betts, Charles D. Bunce, Lloyd W. Dillingham, Howard A. Fear, Blair Hale, C. C. Harwood, Philip George Hills, Farrand E. McIntyre, Merl F. Miller, Raymond Miller, Harold S. Pelton, D. H. Seiter.

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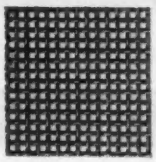

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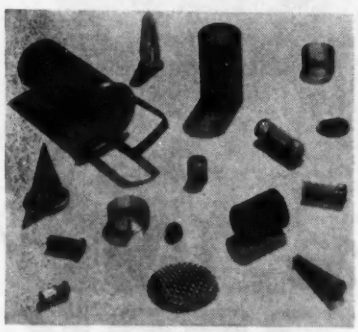

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Oregon Section: Ensign Richard H. Hunger, Tinsley Davis Miller, Douglas D. Moore.

Philadelphia Section: Alfred J. Ferraro, Burton W. Manth, Ensign Harry L. Showalter, Jr., Gordon K. Stebbins.

Southern California Section: George B. Adams, James B. Atkisson, James Henry Boatner, Alden Bivins Carder, Joseph N. Carter, Richard C. Colyear, Chadwick S. Dauwalter, Forest E. Draper, Russell Albert Elfors, John H. Engel, Howard Field, Jr., James B. Ford, John D. Giltseh, Del F. Greenblatt, Robert Gordon Gustavson, Dwight Williams Huntington, Walter J. Hyatt, George Glen Johnson, William A. Johnson, Jr., R. J. Kerr, Charles S. Knotts, Howard D. Kurtz, Steven W. Leong, William G. Letts, Charles H. Lynam, Howard V. More, Donald B. Morse, Charles H. Nelson, Christian Nielsen, Arthur F. Noyes, Fred T. Roberts, Jr., Robert D. Rothi, Frederick John Savaglio, Capt. Thomas J. F. Sherman, Daniel S. Stouffer, A. W. Talley, Robert Stanley Thompson, Henry Chess Trich, Floyd L. Wallace, John T. Weber, Kenneth Arden Woolsey.

Southern New England Section: Ralph P. Alex, L. H. DeWyk, Jr., Stanley W. Evaskus, William Frank Hale, W. C. Robinson, George R. Sprague.

Southern Ohio Section: Richard P. Hulsebus, Francis J. Markey, Raymond E. Rader.

Spokane Group: Don Ware Dayton, Peter J. Favre, J. G. McDonald, Thomas Harold Naismith, Leon F. Olney.

Syracuse Section: James Mercer Beauchamp, Jr.

Texas Section: H. Vaughan Wilcoxson.

Twin City Group: J. D. Mooney, Harry F. Wagner.

Washington Section: Suren I. Akopian, M. S. Burkov, Thaddeus Walter Czuba, Jesse T. Duck, Lt. Henry S. Morton, E. K. Owens, V. F. Rodinov, Carl H. Roeder, Neil A. Smith.

Western Michigan Section: Ernest A. Thompson, John Walker, Paul T. Ward.

Wichita Section: John W. Dallas, Loren J. James, Walter R. Loewen, Joe Howard Miles, Mervin W. Myers.

Outside of Section Territory: W. M. Carney, W. N. Donaldson, Edward Donley, Lt. P. C. Downey, C. T. Evans, Jr., Syvert A. Gunness, Lt. Edward M. Kaliff, George W. Martin, Robert Quarrington Maxwell, William Bowers Meredith, James C. Torreano.

Foreign: Arthur Edward L. Collins, India; Frank George-Davies Edwards, England; Gerald F. P. Fox, Scotland; Lt.-Col. Ewen McEwen, England; John Duncan Roberts, India; Anthony Cyril Rudd, England.

NEW MEMBERS Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between Oct. 10, 1944, and Nov. 10, 1944.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Canadian Section: William H. Banfield (J), Edgar J. Bradbury (M).

Chicago Section: Lt. (jg) William Bernard Crump (J), George E. Stoll (M).

Cleveland Section: John Reese Esterly (J), George H. Lieser (M), Stuart C. Plummer (M), Frank B. Robb (A).

Detroit Section: Charles A. Armitage (J), Grover C. Farnsworth (M), Robert H. Malcolm (J), Warren M. Merrill (A), Louis B. Taylor (M).

Metropolitan Section: Joseph W. Mallach (M), Joseph Marinelli (J), Joseph D. Roughgarden, 2nd (J), Harrison Wood (A).

Northern California Section: Frederick Maxwell Ball (M), 1st Lt. James J. Duffy (S M).

Northwest Section: W. Anthony Arntson (A).

Oregon Section: Victor L. Brandt (A).

Philadelphia Section: John F. Bosler (M).

St. Louis Section: John Rudolph Rose (A).

Southern California Section: Garrett H. Edgell (J), Walter L. Goodman (M), Gerry Gwynne (A), Henry M. Livran (M), Harry S. Richer (M), Frank Benjamin Tipton (M), Orville L. Wilkinson (J).

Southern New England Section: U. S. Time Corp. (Aff.), Reps: Donald A. Hilliard, J. R. Putnam.

Texas Section: Tony G. Whitener (A).

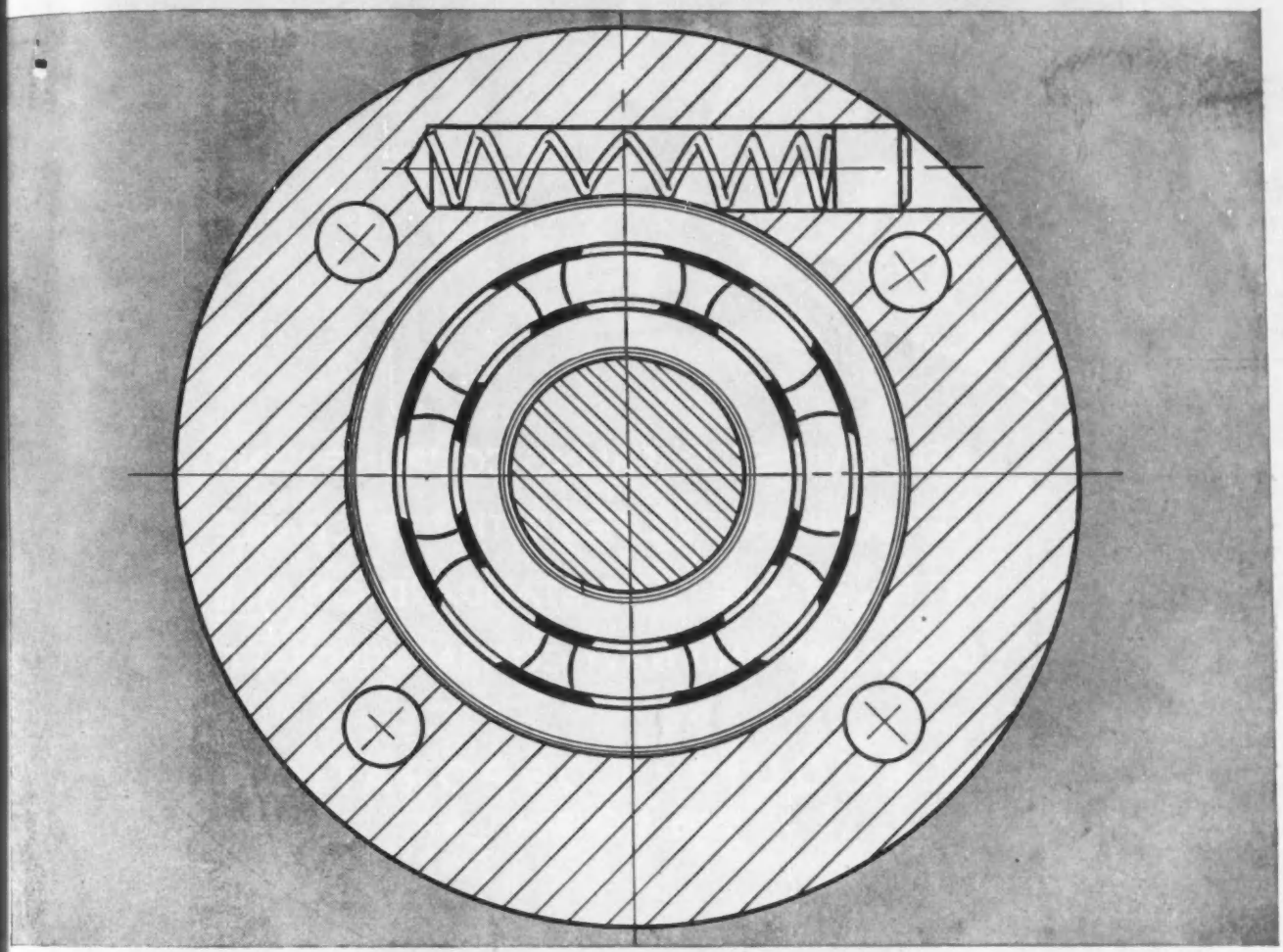
Washington Section: Lt. Robert A. Grosselfinger (J).

Outside of Section Territory: Harvey R. Knoll (A), Capt. William John Long, Jr. (J), Flight Lt. Robert William Marriott (A), Robert F. Painter (J), Torg Primdahl (A), Michael Sarullo (A), Lt. John Milton Scarlett (A), C. Kenneth Strickland (A).

Foreign: Arthur William Judge (F M), (England), Major Edward H. W. Partridge (F M), (England), James M. Whiteley, Jr. (F M), (N.W.I.).

A Bearing Tip . . .

for your design notebook



When small ball bearings, often run at higher speeds, must be mounted loose in the housing, a spiral spring contacting the outer ring as shown above, is a simple and effective means of preventing excessive slippage, housing wear and resultant formation of iron oxide. When correctly proportioned the coils of the spring are distorted and impose a certain amount of radial pressure on the outer ring. While this does not prevent axial movement of the bearing it does have the effect of stopping the ring from excessive rotation in either direction. New Departure engineers will gladly give further details. Ask for our new series of novel yet practical bearing mounting ideas for specific condition problems. 3326

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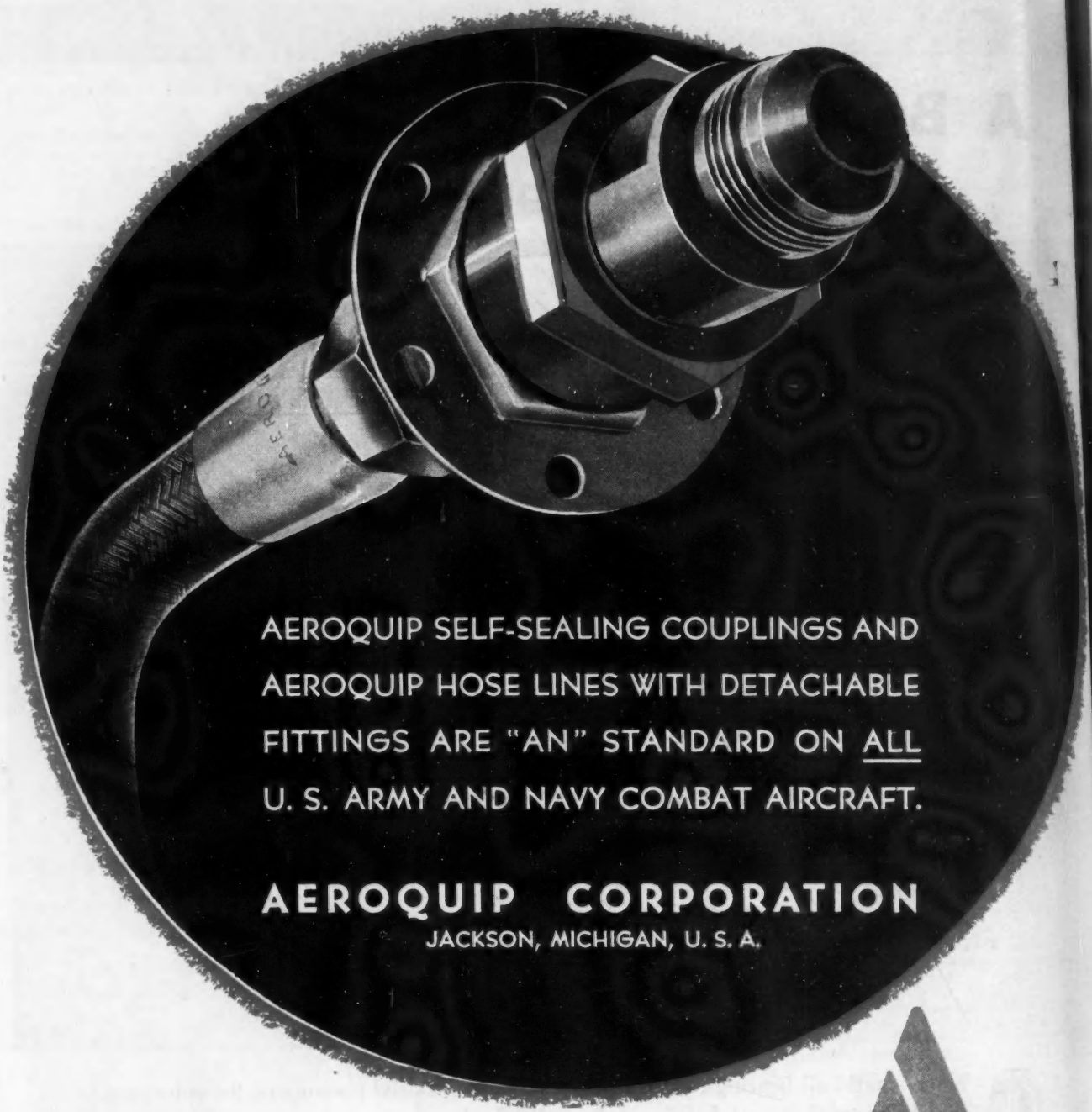

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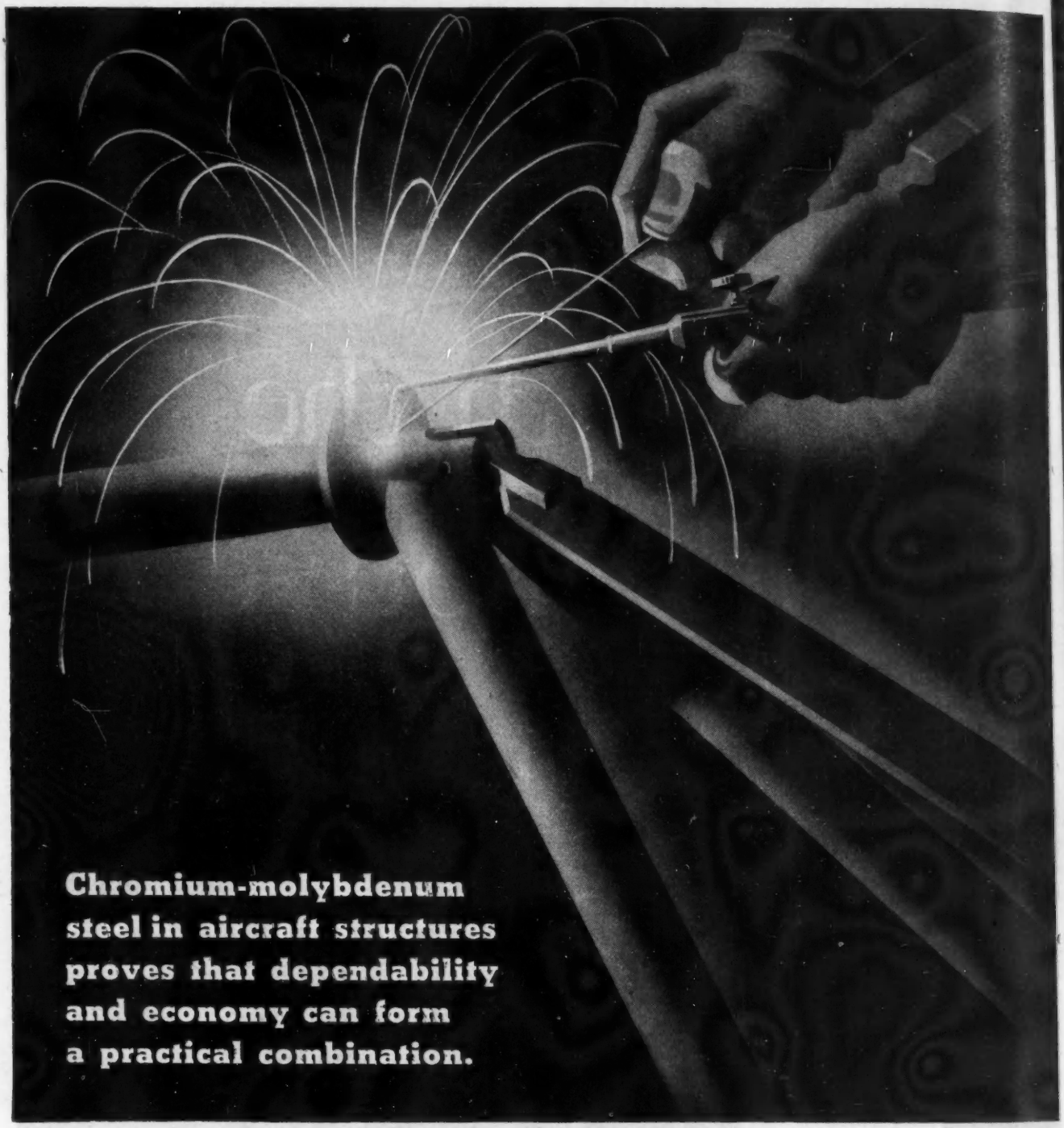

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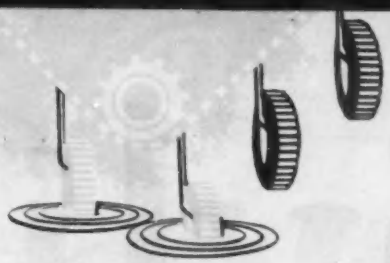

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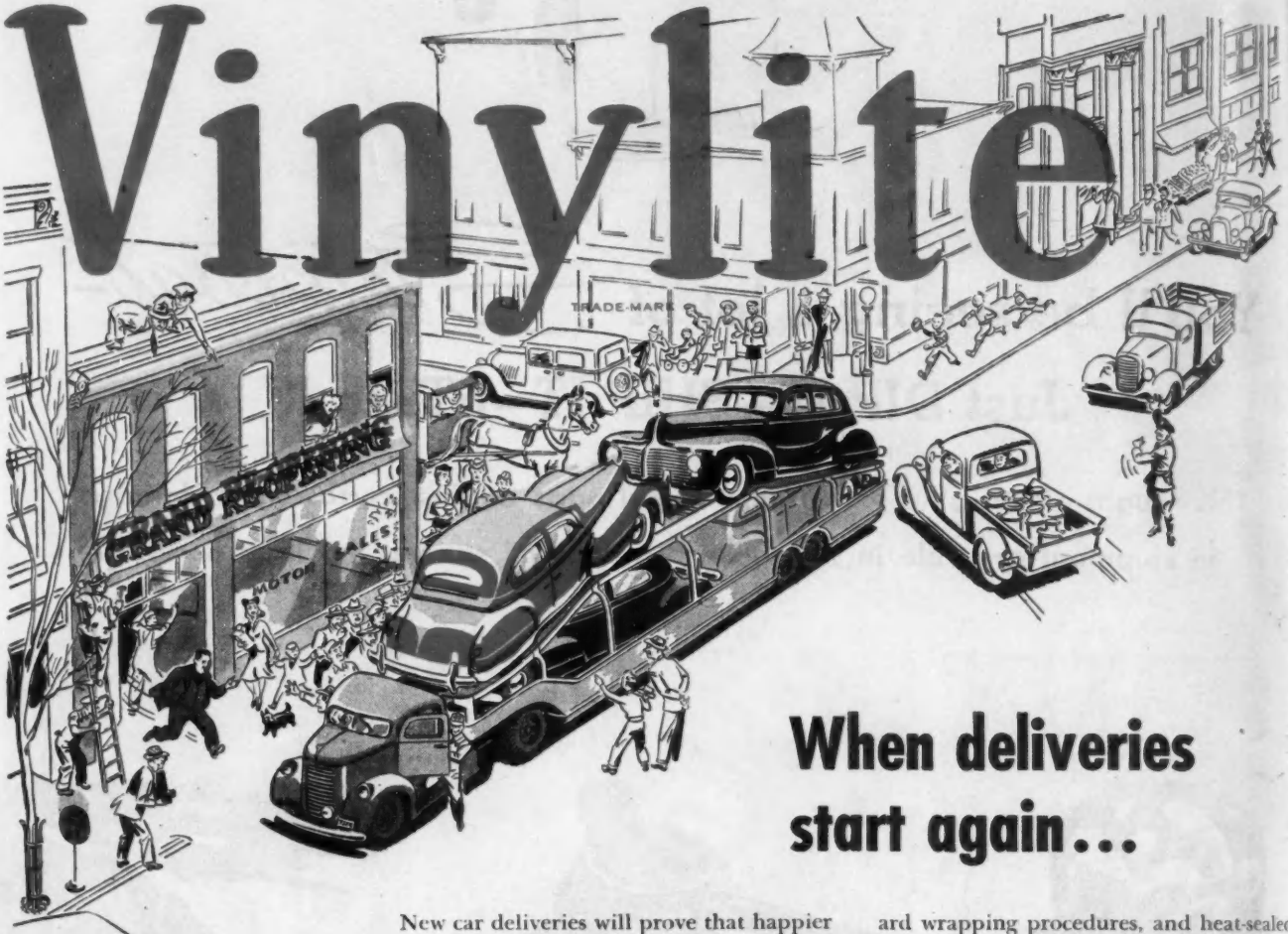

When deliveries start again...

New car deliveries will prove that happier days are here again. Though they look like prewar models, they'll be better cars—improved in many ways. Harness-type wiring systems wrapped in VINYLITE plastic tape, for instance, will be far safer and more dependable than any former assemblies. This unique tape is used on the multiple circuit harnesses of almost every combat vehicle and truck that's built today.

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Besides their use as insulating tapes, VINYLITE plastics are available as extrusion materials for primary insulation, tubular jacketing, and conduits. Wherever used, they bring new economy and safety to the electrical wire and cable field. You will probably find them a real investment in connection with your own products, present or planned. Write for descriptive booklet 29-VR, "Vinylite Plastics for Wire and Cable Insulation."

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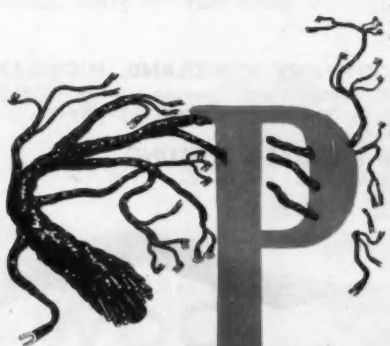

Plastics

THE SATURDAY EVENING POST

Could be — your morning pancakes may turn golden brown in a push-button, electronic kitchen like this . . . come peace. The Little Woman may wear a house dress that looks like something from Mars . . . after the war. You may be celebrating the first anniversary of V-Day in a super-de-luxe air-conditioned goldfish bowl . . . yes, could be.

Personally we don't think so. We don't think such violently dramatic changes will come over night. But we *do* think there'll be improvements . . . immediate improvements, improvements in many things to make life easier, healthier, happier and less expensive.

And somewhere in the line-up of new gadgets and machines and toys, Acushnet will have a part. We will be supplying articles molded of rubber and synthetic rubber to makers of all sorts of products designed for your comfort, convenience and pleasure.*

Many of these articles you may not actually see. But if, in nineteen-forty-something, your washing machine runs a bit smoother, or your car goes further on less oil, or your radio sounds better, it may well be because some part of it is the result of what we have learned in making articles of war, well enough to win four Army-Navy "E" Awards in succession. Acushnet Process Company, New Bedford, Massachusetts.

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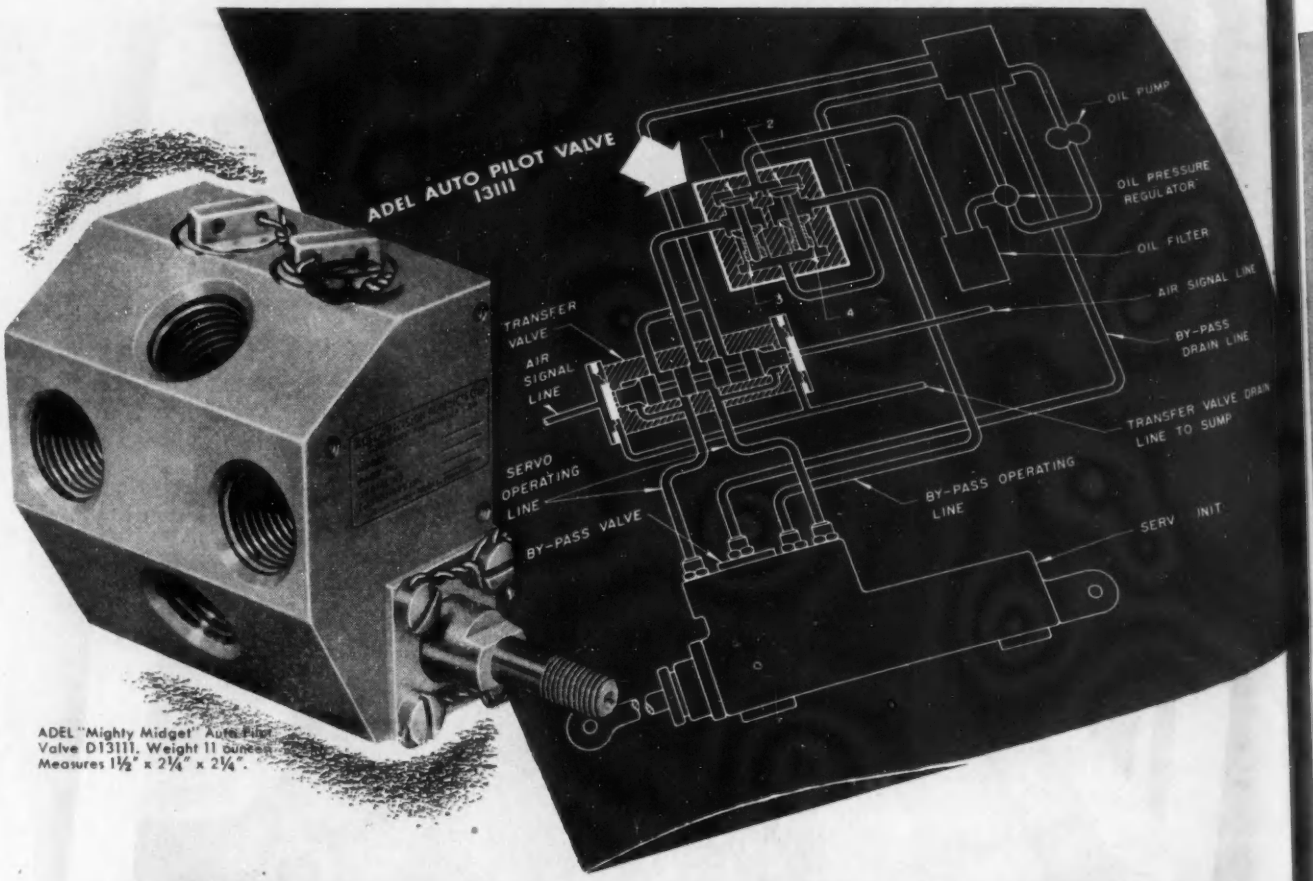
This particular one runs December 2nd.



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WIDE BASE RIMS

- Two separate bus operations, after converting to wide base rims, showed mileage increases of 15 and 18 per cent.
- An overland hauling company, after switching from standard to wide base rims, increased its pre-recap mileage from 44,000 to 68,000 miles.

WIDE base rims are setting such mileage records because they get peak performance and longer tire life from today's synthetic rubber truck tires in five important ways:

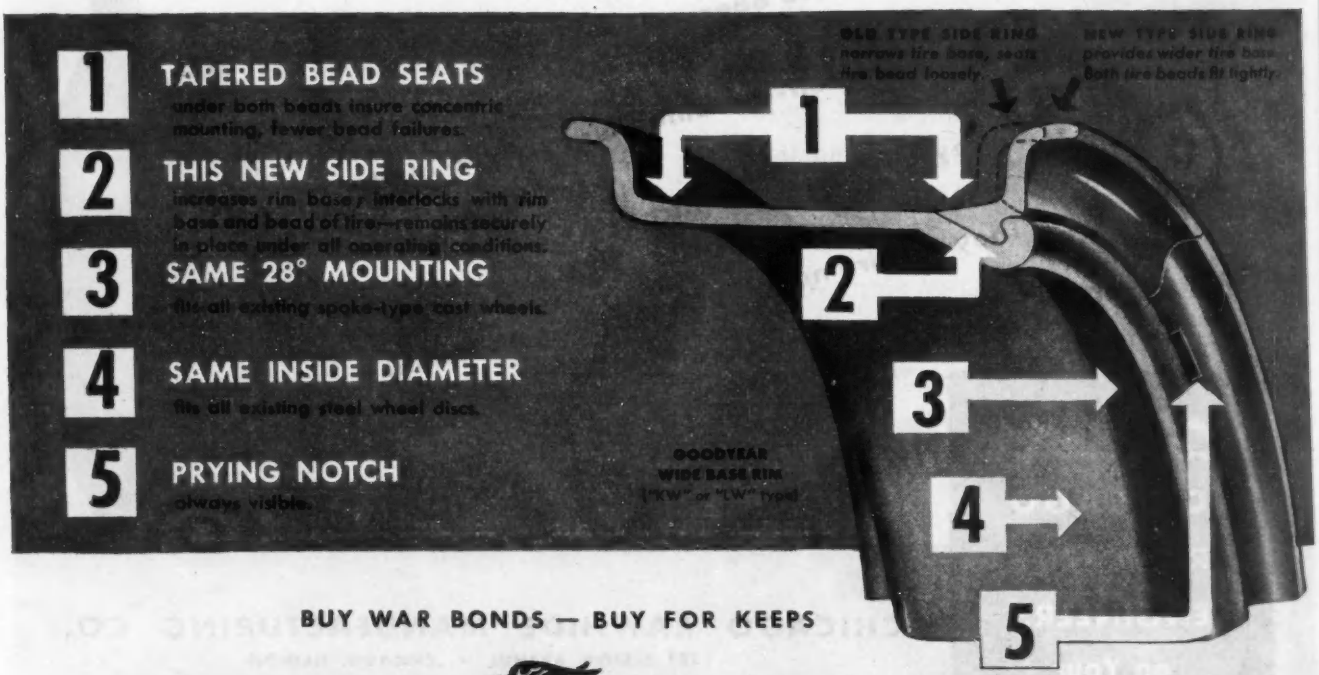
1. Generate less heat in tire shoulder. (Narrow rim width causes excessive flex in sidewalls.)
2. Increase tire mileage, with carcass preserved for more retreads.
3. Reduce rolling deflection by 12½% when rim width is correctly increased to about 70% of the tire's sectional diameter.
4. Increase stability, reduce sway — both resulting in more positive steering response.
5. Put tapered bead seats under *both* tire beads, reducing chafing and bead failure.

Goodyear Rims make it possible to get the full measure of rim width you want with a simple, switchover plan. Here's how:

If you have standard demountable rims of any make with 28° mounting bevels, replace them with Goodyear's new type KW or LW Wide Base Rims. Where disc wheels are used these same Goodyear Wide Base Rims are available attached to discs of all standard makes. In either case 100% interchangeability is maintained.

If your vehicle is already equipped with Goodyear Standard Rims, you can take a partial step toward a full wide base installation by merely replacing the existing side rings with the new Goodyear KW or LW rings.

Switch to wide base rims through this easy, single-step operation. See your Goodyear Rim Distributor now


1 TAPERED BEAD SEATS
under both beads insure concentric mounting, fewer bead failures.
2 THIS NEW SIDE RING
increases rim base; interlocks with rim base and bead of tire—remains securely in place under all operating conditions.
3 SAME 28° MOUNTING
fits all existing spoke-type cast wheels.
4 SAME INSIDE DIAMETER
fits all existing steel wheel discs.
5 PRYING NOTCH
always visible.
OLD TYPE SIDE RING
narrows tire base, seats tire bead loosely.
NEW TYPE SIDE RING
provides wider tire base. Both tire beads fit tightly.
GOODYEAR WIDE BASE RIM ("KW" or "LW" type)

BUY WAR BONDS — BUY FOR KEEPS

GOODYEAR RIMS

PRODUCTS OF GOODYEAR RESEARCH

"Big war story 'way behind the lines!"

No matching wits with Messerschmitts, no bombing missions fraught with mischance and flak, no daring deeds that merit decoration, but a significant story in smudged service records.

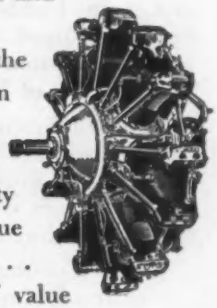
With the war under way the AAF picked the Jacobs engine for twin-engine trainers to school the bomber pilots and bombardiers.

A pre-war engine, developed during the Depression years, the Jacobs had proved itself a simple, rugged engine that stood up for long periods in all kinds of work and weather, with little maintenance. No government money went into its development. Ready for production, thousands were ordered.

FOUR years ago, the Jacobs was rated by the Army as good for 350 hours of flight time between major overhauls—long service shift for an engine handled by student pilots, taking more take-offs and more time at full throttle than engines used in any other type of flying.

As the flight hours piled up, it was found that the Jacobs was good for more than 350 hours; and the service period was extended again and again. Today, the service period of the Jacobs is as high as 1,200 hours—equivalent to 180,000 air miles of flight, not counting taxiing, and ground time.

Because it delivered more than three times the original specified service hours, the Jacobs not only speeded up training schedules, but also saved the AAF and the taxpayers millions of man-hours in shop time and maintenance.



Built to work, built to last . . . the Jacobs will mean more in peace than in war—when safety and low costs are essential to commercial flying.

The engine also certifies the ability of Jacobs to put extraordinary value into precision-built mechanisms . . . stands as a reliable guaranty of value on any product that will carry the Jacobs name plate. Watch for it, and you won't go wrong! . . . Jacobs Aircraft Engine Company, Pottstown, Pennsylvania.

JACOBS • **Pottstown, Pa.**

HIGH-SPEED HIGHWAY TRANSPORTATION *safely...with low-cost operation and upkeep*

NATIONAL TRAILWAYS ensures it with FITZJOHN FALCONS...powered by

WAUKESHA ENGINES

● National Trailways passengers are to have faster, safer, smoother rides, in roomier, more comfortably and more attractively appointed coaches—FitzJohn Falcon Coaches—powered by Waukesha Engines. For during 1944 alone, Trailways are adding over a million dollars' worth of these Waukesha-powered FitzJohns.

Transportation progress is a matter of co-operation—between coach operators, coach makers, and engine builders. As a result Waukesha engineers have developed an engine with added refinements and improvements that meets the specifications and power needs of FitzJohn Falcon Coaches.

This Waukesha Model 140GK Engine is speedier, smoother—with super power and stamina—that not only has greater flexibility but greater dependability. Power costs are lower because fuel cost is less and maintenance expense is lower.

The Waukesha Model 140GK Engine has every streamline feature including: Aluminum Pistons • Removable Wet Sleeve Cylinders • 7-Bearing Crankshaft • Precision Bearings • Overhead Valves • Dual Valve Springs • Adapted to Distributor or Magneto Ignition • Up or Down Draft Carburetion • Full Pressure Oiling • Thermostat Controlled Cooling • Electrical Equipment Includes Bus Type Generators and S.A.E. Mounting Starters • Standard Connections for Approved Automotive Accessories, such as air brake compressors, oil filters, oil coolers, fuel pumps, dash-mounted oil and temperature gauges, and bus heaters. *Get Bulletin 1161.*

Intake Side—Model 140 GK Six Cylinders 4½-inch bore, 5½-inch stroke 525 cu. in. disp. 140 hp. . . . 2200 r.p.m....gasoline or butane.

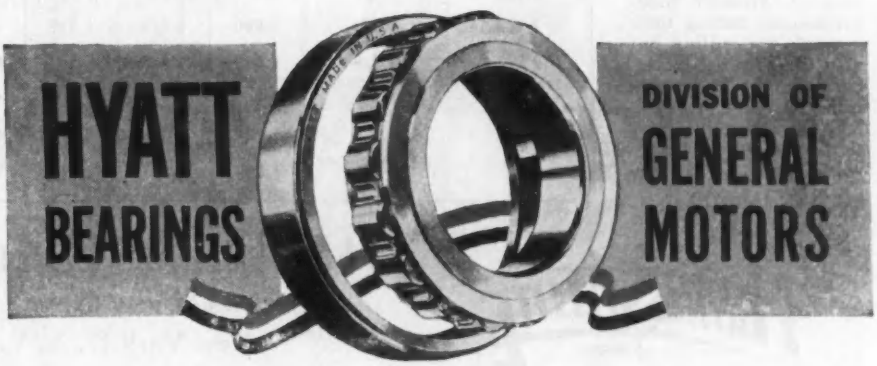
MORE POWER FOR VICTORY

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN • NEW YORK • TULSA • LOS ANGELES

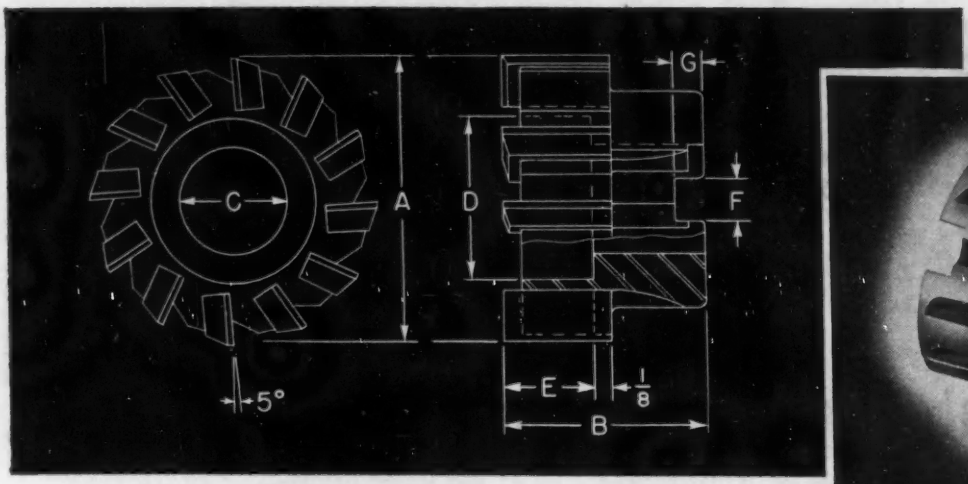
★ **Protecting** the vital operating parts of engine crankshafts; superchargers, and inertia starters are the dependable Hyatt Roller Bearings...into which we build great stamina and capacity, while holding them true to required precision tolerances...

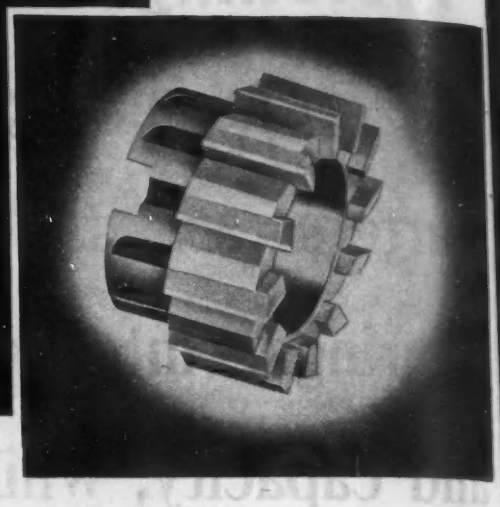
And at the same time...on railway and highway and farm, in mill and factory... oil fields and construction jobs...wherever wheels and shafts turn...millions of Hyatts are serving America!

Hyatt roller bearings are built to last—and require a minimum of care. But don't forget to give them the proper attention all precious anti-friction bearings deserve today.



HYATT BEARINGS DIVISION · GENERAL MOTORS CORPORATION · HARRISON, NEW JERSEY





Use HAYNES STELLITE END MILLS For Faster Milling!

HAYNES STELLITE shell end mills with brazed-in blades are fine-pitch cutters developed for faster milling. These end mills are operated on cast iron, malleable iron and semisteel, with a chip load of 0.10 to 0.15 in. per tooth. They are also successfully used on mild steel with a load of 0.005 to 0.010 in. per tooth. On nonferrous metals, and on plastics, hard rubber, or fiber, the chip load is often increased to 0.030 inch.

These high-production tools are operated on light milling jobs at surface speeds as high as 300 ft. per min. on cast and malleable irons—600 ft. per min. on brass —1,200 ft. per min. on aluminum.

HAYNES STELLITE alloy cutters are finished according to the A.S.T.E. Simplified Practice Committee standards for milling cutters to fit standard arbor equipment. Sizes other than those shown in the table can be made upon request.

Diameter (A)	Thickness (B)	Hole (C)	Counterbore (D)	Counterbore (E)	Drive Slot (F)	Drive Slot (G)	Size of Blades	No. of Teeth
1 1/4	1	0.500	11/16	3/8	0.260	5/32	3/16 x 1/4 x 1/2	8
1 1/2	1 1/8	0.500	3/4	1/2	0.260	5/32	3/16 x 5/16 x 5/8	10
1 3/4	1 1/4	0.750	1 1/6	1/2	0.322	3/16	3/16 x 5/16 x 5/8	10
2	1 3/8	0.750	1 1/8	5/8	0.322	3/16	3/16 x 3/8 x 3/4	12
2 1/4	1 1/2	1.000	1 3/8	3/4	0.385	7/32	3/16 x 3/8 x 7/8	12
2 1/2	1 5/8	1.000	1 3/8	7/8	0.385	7/32	3/16 x 1/2 x 1	14
2 3/4	1 5/8	1.000	1 5/8	7/8	0.385	7/32	3/16 x 1/2 x 1	14
3	1 3/4	1.250	1 7/8	1	0.510	9/32	1/4 x 1/2 x 1 1/8	14
3 1/2	1 7/8	1.250	2 1/8	1 1/8	0.510	9/32	1/4 x 5/8 x 1 1/4	16
4	2 1/4	1.500	2 1/2	1 1/4	0.635	3/8	1/4 x 5/8 x 1 3/8	18

Send For Free Booklet

For more information on HAYNES STELLITE high-production cutting tools not only for milling, but also for turning, facing, boring, and other operations, write for the booklet "Operating Information on Haynes Stellite 98M2 Tools." Ask for F-5350.

HAYNES STELLITE TRADE-MARK

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York 17, N. Y. UCC Kokomo, Ind.

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

• HIGH-PRODUCTION METAL-CUTTING TOOLS •

"*HAYNES STELLITE*" is a registered trade-mark of Haynes Stellite Company.

Approved

BY BOTH

ARMY & NAVY

THE MARMAN UNIVERSAL HOSE CLAMP—SERIES 820

Now, for the first time, one clamp combines *all* these features: ✓ stainless steel construction ✓ re-usability ✓ self-locking screw with high back-off torque ✓ corrosion resistance ✓ adjustability —3 sizes handle hose diameters from 11/16 to 3-9/16 O. D. ✓ non-slipping band conforms to hose contour and clamps irregular shapes with equal efficiency.

Marman also makes standard fixed contour hose clamps in stainless steel and aluminum alloy, as well as the Marman Quick-Coupler in stainless steel or aluminum alloy. Write today for *new* folder, Series 820.

MARMAN PRODUCTS CO. Inc.
940 WEST REDONDO BOULEVARD
INGLEWOOD, CALIFORNIA.

EASIER TO INSTALL!

1. Retract screw fully. Wrap band around hose and insert end through opening in saddle.

2. Pull up snug, fold band down inside saddle, tighten screw.

Marman's exclusive swivel-action nut rocks on swivel pins and when screw is tightened, tips down, cinches band and prevents slipping.

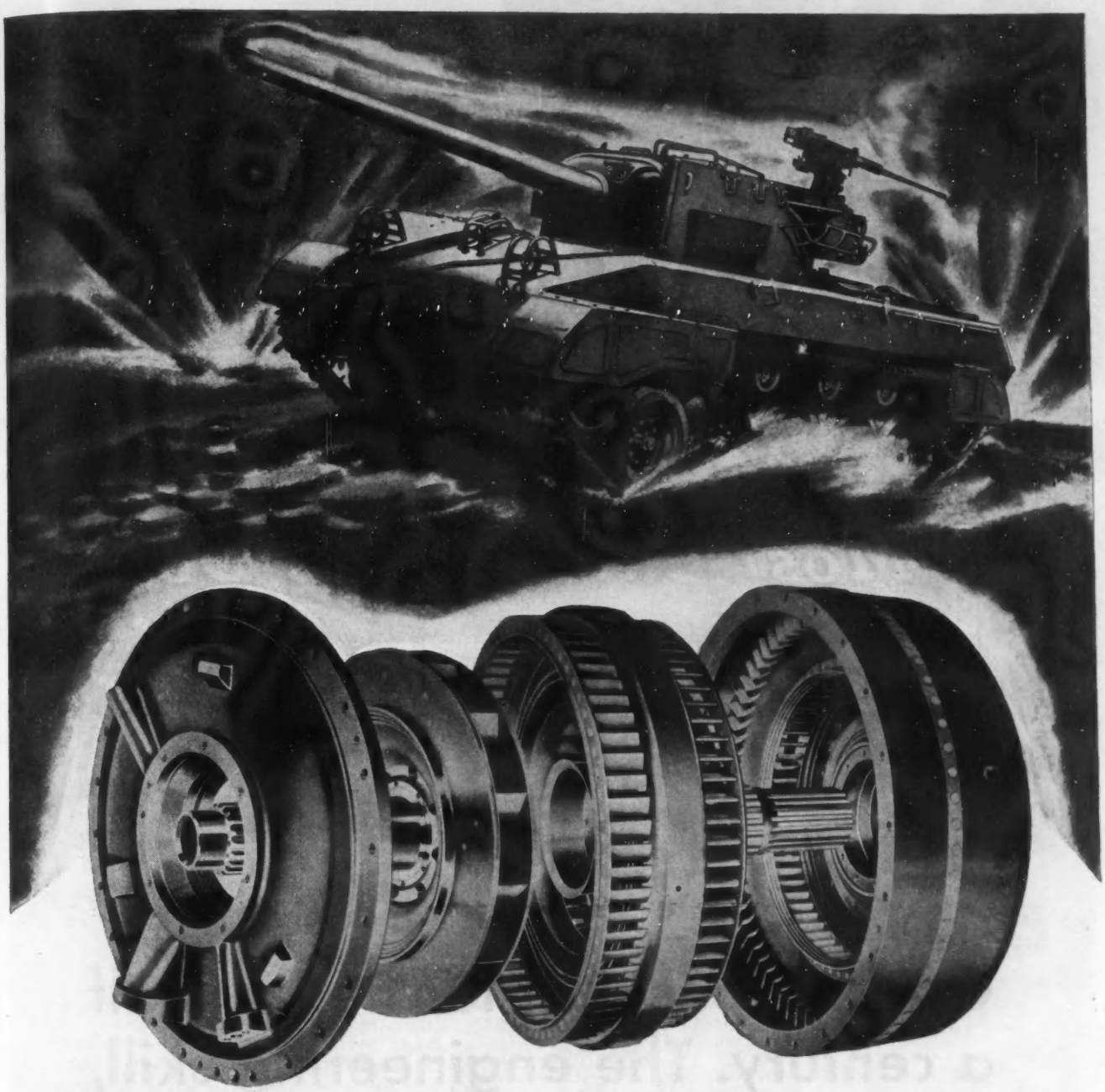
Another big rush on Long Distance lines this Christmas...

It was a big rush last year. It may be even bigger this Christmas.

So please help keep Long Distance lines clear for essential calls on December 24, 25 and 26.

War still needs the wires — even on holidays.

BELL TELEPHONE SYSTEM



The amazing "Hell-Cat" Tank Destroyer . . .

Equipped with Spicer Torque Converter

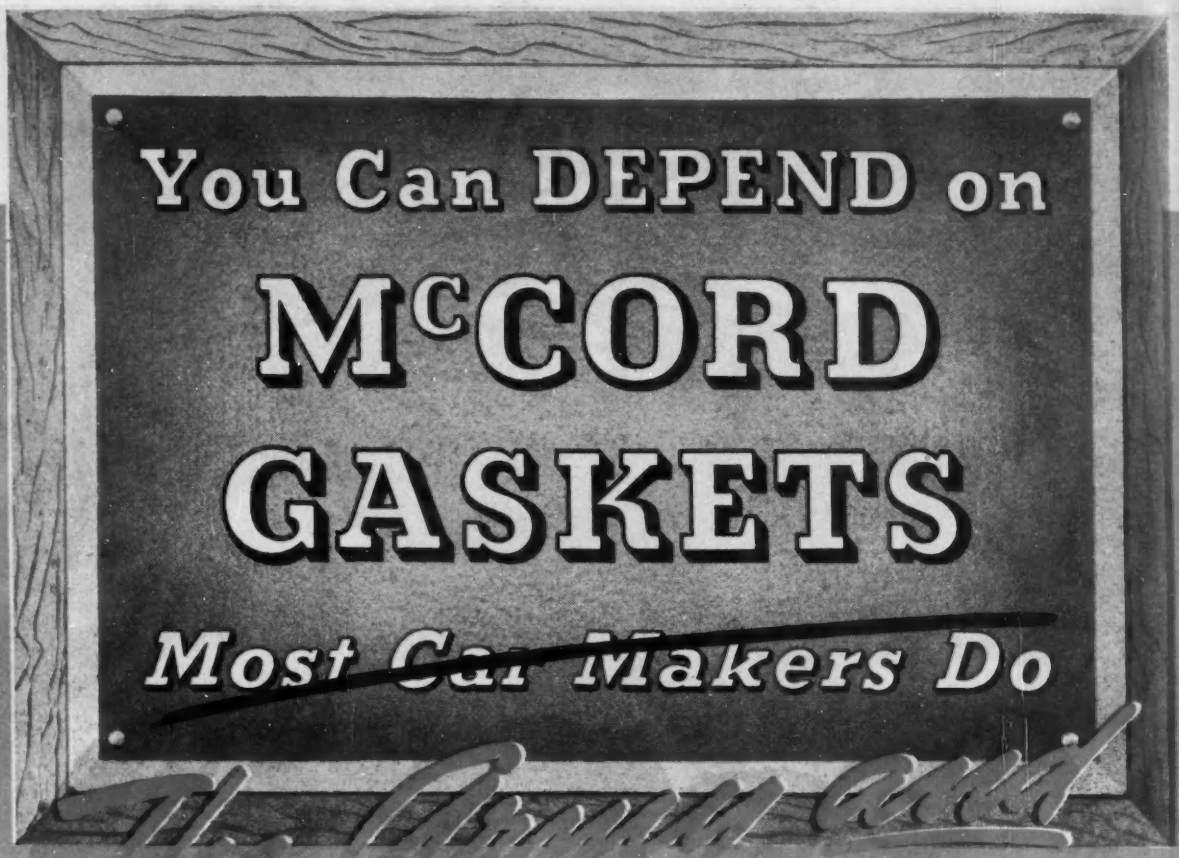
Capable of speeds up to 55 miles per hour, this Tank Destroyer mounts a high velocity 76 MM cannon that can effectively knock out enemy tanks at several thousand yards. Its superior performance enables it to out-maneuver, outspeed and out-shoot the most formidable enemy equipment . . . at the same time making it the most elusive target in modern tank warfare. Many of these advantages are secured with the help of the revolutionary Spicer Torque Converter. It has been in service in the M-18 Tank Destroyer for over a year, and will again be ready for civilian carrier and transport use when peacetime production starts. Spicer Manufacturing Corporation, Toledo, Ohio.

Spicer Corporation is the sole licensee for the production of this torque converter for Busses and Trucks under Lysholm-Smith patents.

41 YEARS OF Spicer SERVICE

BROWN-LIPE CLUTCHES AND TRANSMISSIONS • SALISBURY FRONT AND REAR AXLES

SPICER UNIVERSAL JOINTS • PARISH FRAMES, STAMPINGS



Gasket specialist for nearly half a century. The engineering skill, the experience of the pioneer is available to you in solving your GASKET PROBLEMS

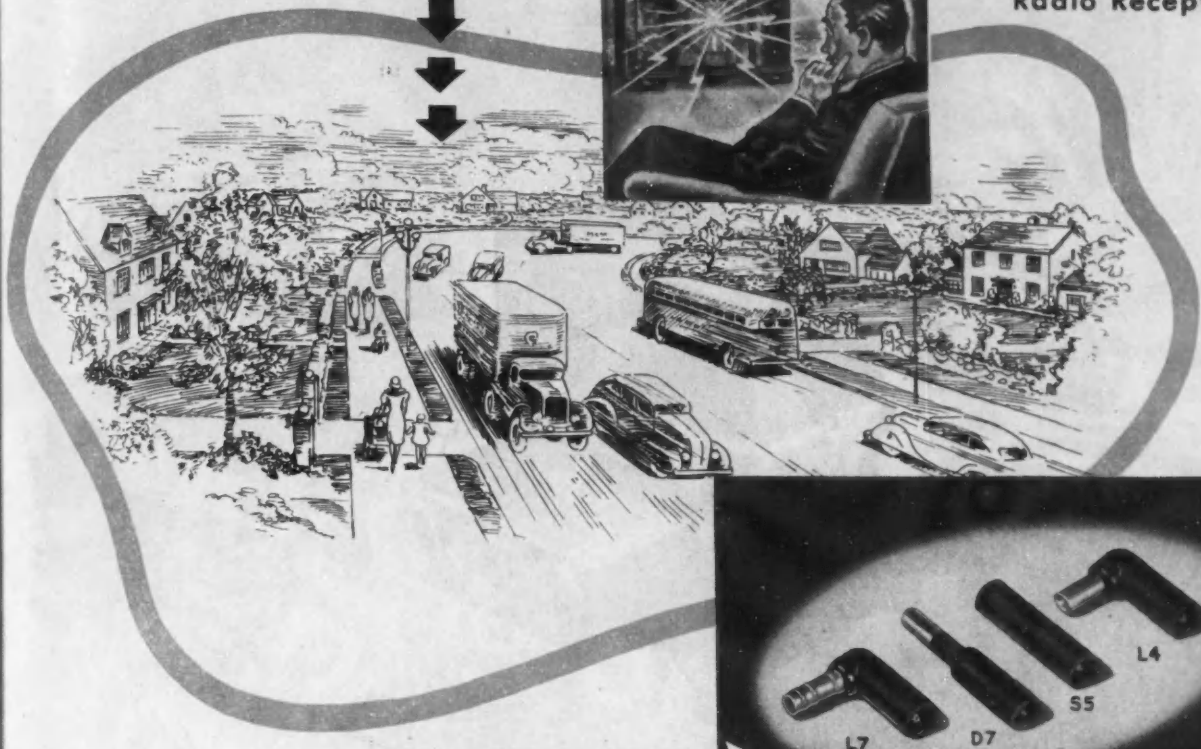
GASKETS • RADIATORS
MECHANICAL LUBRICATORS • UNIT HEATERS

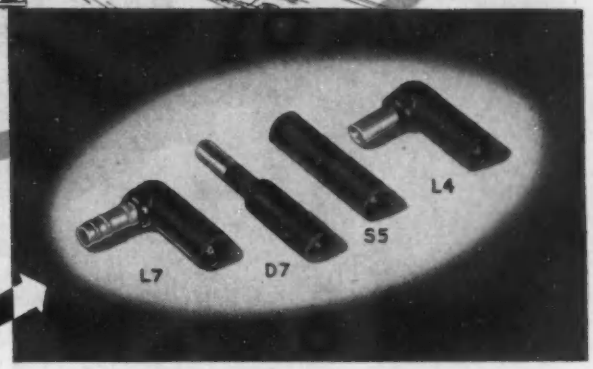
cause . . .

High Frequency
Ignition Emission

. . effect

Interference with
High Frequency
Radio Reception





REMEDY

use *Erie Suppressors* for Elimination of Ignition Noise in Radios

COMBAT experience has proved that, where high frequency electronic communications equipment is used, it is necessary to equip *all* gasoline powered vehicles in the area serviced by the transmitter with suppressors, to eliminate high frequency ignition interference in nearby receiving equipment.

This wartime lesson points to the necessity of making the reception of peacetime FM, Television, and other high frequency transmissions, free from these disturbances, since even in comparatively quiet residential section radio reception will be affected by passing motor traffic.

The most efficient method of accomplishing this is to equip *all* passenger and commercial vehicles with suppressors, regardless of whether or not the vehicles have automobile radios.

The illustration above shows four types of Erie Suppressors, type S-5 and D-7 for distributor cables, type L-4 for spark plugs, and type L-7 for both spark plugs and distributors.

Erie Suppressors have been used in large quantities on pre-war cars and wartime military equipment. Erie's low voltage coefficient gives maximum suppression efficiency without the necessity of using high resistance values that impair engine efficiency. Data sheet giving complete information on Erie suppressors will be gladly sent upon request.

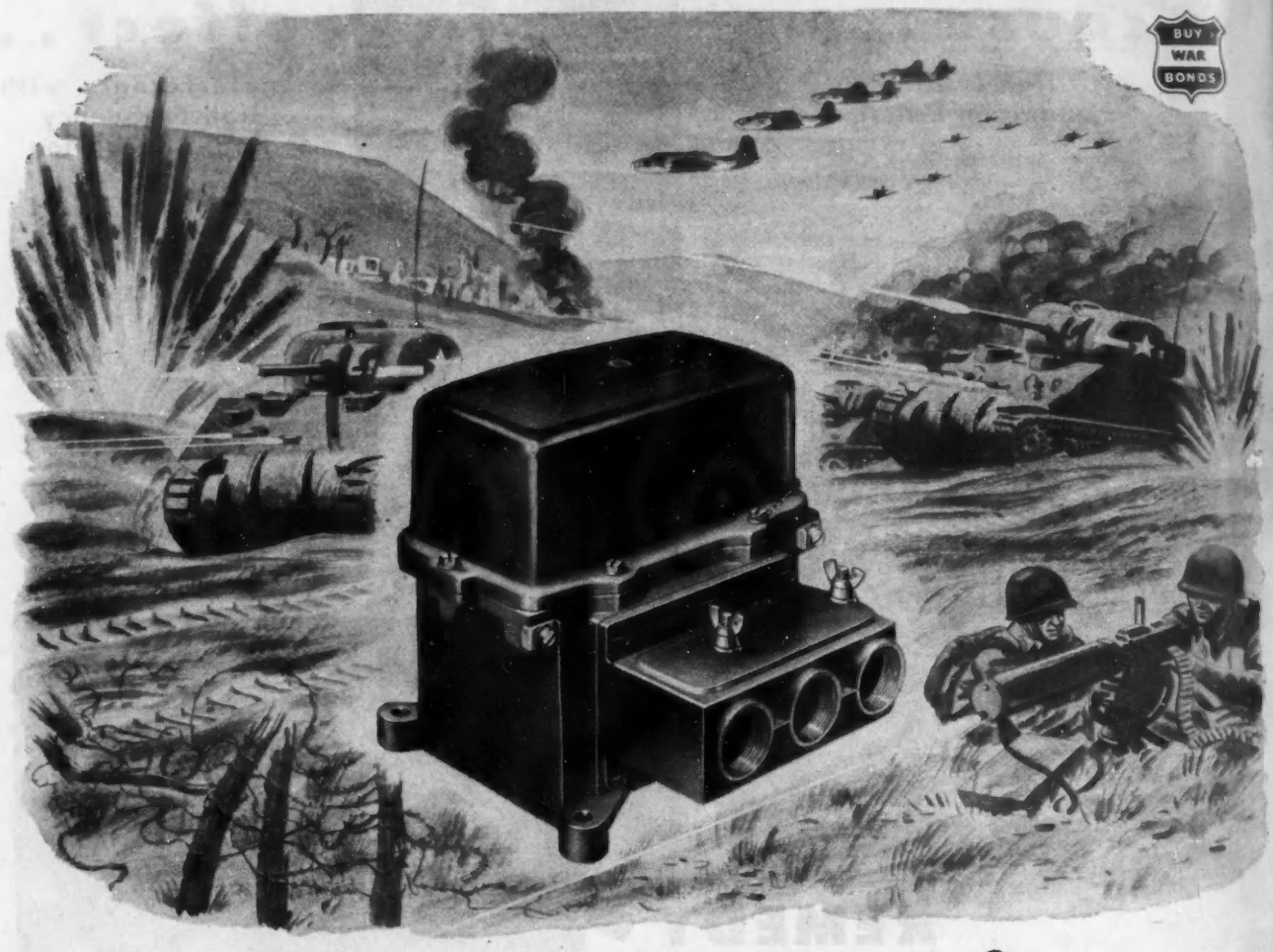
ARMY E NAVY
FOR HIGH ACHIEVEMENT IN WAR PRODUCTION

Electronics Division

ERIE RESISTOR CORP., ERIE, PA.

LONDON, ENGLAND • • TORONTO, CANADA

★ ★ ★ Do More Than Before—Buy EXTRA War Bonds ★ ★ ★



Improved 3 ways for Battlefield Reception...

In this war of movement, when battle orders usually travel by radio, any interference in reception can be dangerous, disastrous!

Early in the war, one serious source of radio interference came from the tank generators and their control units. This interference has now been successfully eliminated by the development of an improved control unit by Auto-Lite. Actually, the control unit gives improved reception in three ways: Eliminates radio interference, operates submerged or dry, ups life over 100%.

Advanced engineering achievements such as this again explains why on battlefronts and the homefront the name Auto-Lite means precision manufacturing.

THE ELECTRIC AUTO-LITE COMPANY

SARNIA, ONTARIO — TOLEDO 1, OHIO

AUTO-LITE

SPARK PLUGS · STARTING
LIGHTING · IGNITION
BATTERIES · WIRE & CABLE

TUNE IN "EVERYTHING FOR THE BOYS"—STARRING DICK HAYMES—EVERY TUESDAY NIGHT—NBC NETWORK

OOD FOR TWENTY-FIVE DOLLARS ANY SUNDAY

rmer Jones could count on at least nty-five extra dollars any summer nday in those good old days . . . ling out the cars which, one by one, gged and panted to a helpless stand- l in the mudhole in front of his place.

the cars which whiz along count- country highways nowadays are troubled by mudholes, hills or gh going. Luxurious, dependable safe, they are the products of an azing quarter-century of automotive gress and of the initiative, vision tremendous energy of the men in this youthful and dynamic industry.

The Eaton organization, by supplying mass-manufactured precision parts for many makes and models of cars, has done its best to contribute to that progress . . . to the development of the modern automobile and of the production methods which made it possible to build such *quality* into cars which rolled off the assembly lines by the hundreds or thousands every day.

The new knowledge and new techniques developed by Eaton in working with automotive and aircraft engineers during the war, have added greatly to the value of Eaton's thirty years' experience with these industries. After the war is completely won, everything that Eaton has in ability, experience and resources will again be devoted to peacetime progress in motor vehicles and aircraft.

EATON

EATON MANUFACTURING COMPANY

General Offices: Cleveland, Ohio

PLANTS: CLEVELAND • DETROIT • SAGINAW
MARSHALL • BATTLE CREEK • VASSAR • MASSILLON

PPLIERS OF FINE PRECISION PARTS TO THE AUTOMOTIVE AND AIRCRAFT INDUSTRIES FOR MORE THAN THIRTY YEARS

A PROMISE TO POSTWAR ENGINE DESIGNERS

For almost half a century, Holley research has pioneered many significant carburetor improvements. The postwar period will see this technical leadership further emphasized. ¶ On postwar highways, skyways and waterways, Holley research will provide engine designers the utmost in engine efficiency, performance and economy of operation. ¶ If carburetion is your problem, Holley experience and facilities will be valuable to you.

HOLLEY

AIRCRAFT, AUTOMOTIVE, MARINE

CARBURETORS AND ACCESSORIES

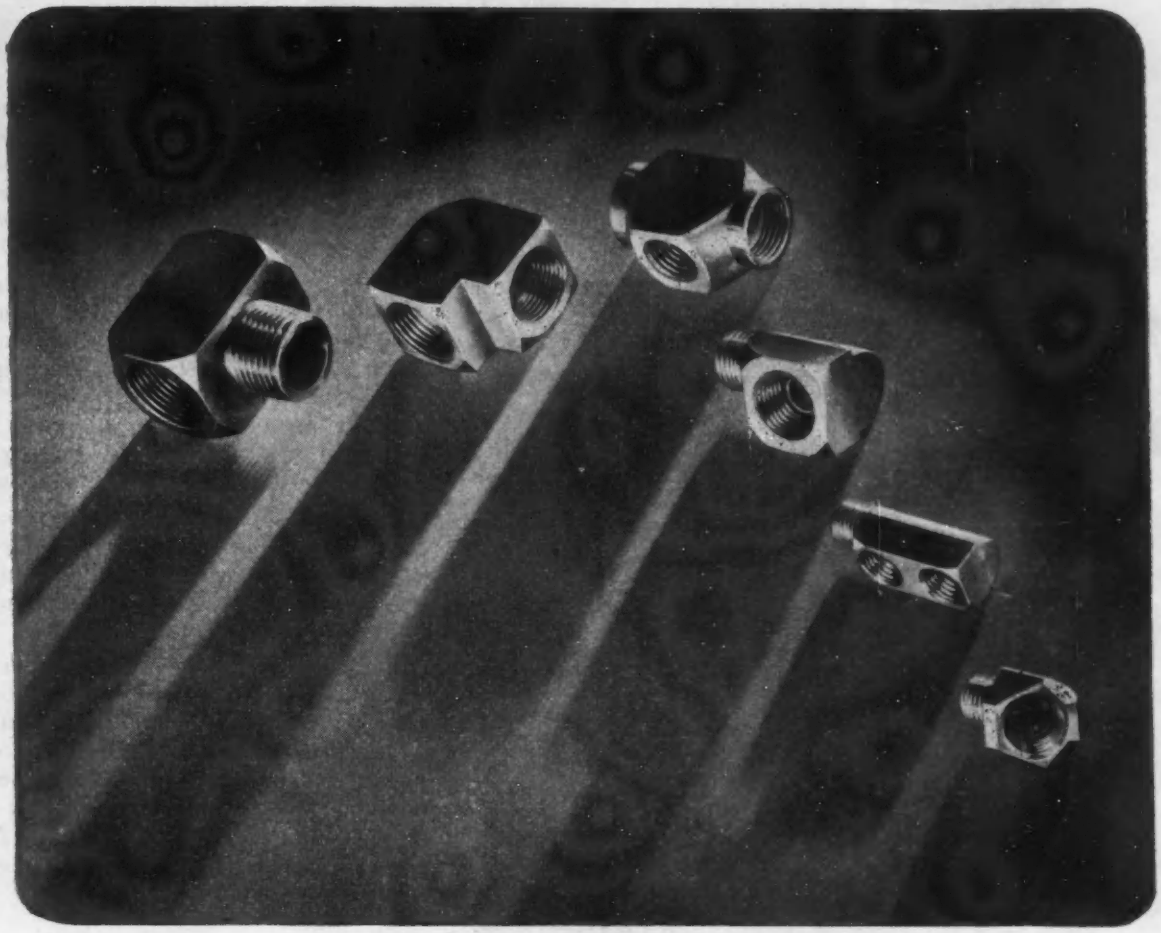
Instruments

OF WAR AND PEACE!

These fittings don't look deadly, do they? But because they are indispensable to virtually every unit of the nation's mobile fighting machines—whether on land, sea, or in the air—they are as effective equipment as exists in the war!

Throughout the war, the four plants of The Weatherhead Company have produced these vital parts at the rate of more than a million a day—and will be prepared to devote their entire facilities to peacetime production in many fields when the Day of Victory comes.

FREE: *Write on company letterhead for "Seeds Of Industry"—a history of The Weatherhead Company, its many facilities and diversified products.*



Look Ahead with

Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO

Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

MORE THAN MACHINES WILL BE

Unveiled after the war

When automobile manufacturers take the wraps off the machinery they stored at the beginning of the war, you also will find the petroleum industry unveiling new and better gasoline.

THE POST-WAR PURCHASER will expect a *basically* better automobile than his present machine. That means more than refinement in body design, new accessories or features. It calls for better engines—*engines that will get more work from each gallon of gasoline.*

The basis for this fundamental improvement already exists. It lies in the development of automotive engines to take full advantage of the greatly improved gasoline which the petroleum industry will produce. For as war needs end, the high-octane components now being produced by refiners for use in military gasoline will find their way into civilian gasoline.

The opportunity that exists for substantial improvements in engine performance because of better fuels is by no means limited to passenger car engines. There is an equal opportunity in the commercial field as well.

Greater engine efficiency may take the form of increased mileage, better performance or a combination of both. In the long run, this will be decided largely by economic factors. But no matter which way the trend goes, the question of "How can we best utilize post-war gasoline?" will likely be both the No. 1 problem and the No. 1 opportunity of the automotive designer.

ETHYL CORPORATION

Chrysler Building, New York City

Manufacturer of Ethyl fluid, used by oil companies to improve the antiknock quality of aviation and motor gasoline.

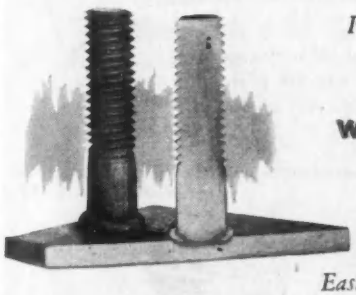
Wartime progress by America's petroleum industry has paved the way for fundamental progress in post-war automobile engine design.

Complete fusion of stud to metal in less than 1/2 second...

The Nelson Stud Welder is simple to operate because the welding is *automatically* controlled. It eliminates the need for drilling, tapping, and hand welding bolts to secure parts, because it end-welds studs directly to the metal surface.

It is used by more than 460 industrial plants and shipyards. Operators are securing 500 to 1500 studs a shift. No previous welding experience is necessary to operate it.

Complete fusion of the stud to metal is obtained by accurate arc timing control, automatic action of the "gun," the use of flux-filled studs, and complete shielding of the arc.



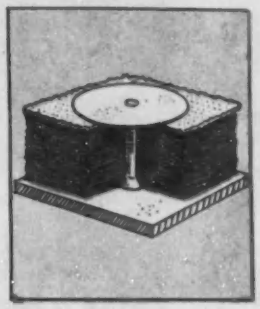
Cutaway view of stud, after etching with Nital.

For complete data, catalog and price list, write:

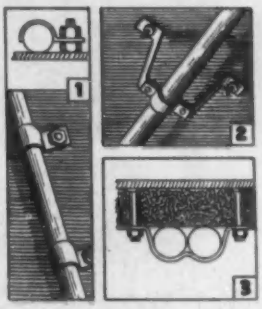
NELSON SPECIALTY
WELDING EQUIPMENT CORPORATION
Dept. S, 440 Peralta Avenue
San Leandro, California

Eastern Representative: Camden Stud Welding Corp. Dept. 22, 1416 South Sixth St., Camden, N. J.

TYPICAL STUD APPLICATIONS



Nelson Insulation Pins are used to secure soft insulation rapidly and economically. They are welded directly through the material without injury to it. Where large metal surfaces must be insulated these pins will save both time and material.



Wiring, conduit, and pipe are quickly secured. Here illustrated are a few methods: 1. Securing conduit. 2. Securing pipe (single and multiple runs). 3. Securing wiring of all kinds over soft insulation material.

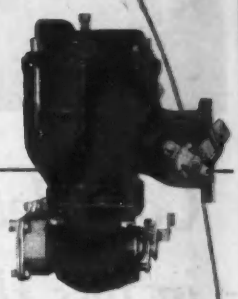
General Maintenance – The Nelson Stud Welder is excellent for all types of small repair work. It can be used anywhere there is need to endweld studs to metal. For securing oil lines; for covers; hooks; air lines; machinery installations; and repairs.

NELSON STUD WELDERS & STUDS

Worth Drawing on—

30 years specialization

in heavy-duty carburetion



When you turn your attention to the carburetion phase of your plans, keep this meaningful fact in mind:

Zenith Carburetor Division has more experience in the field of heavy-duty carburetion than any other manufacturer.

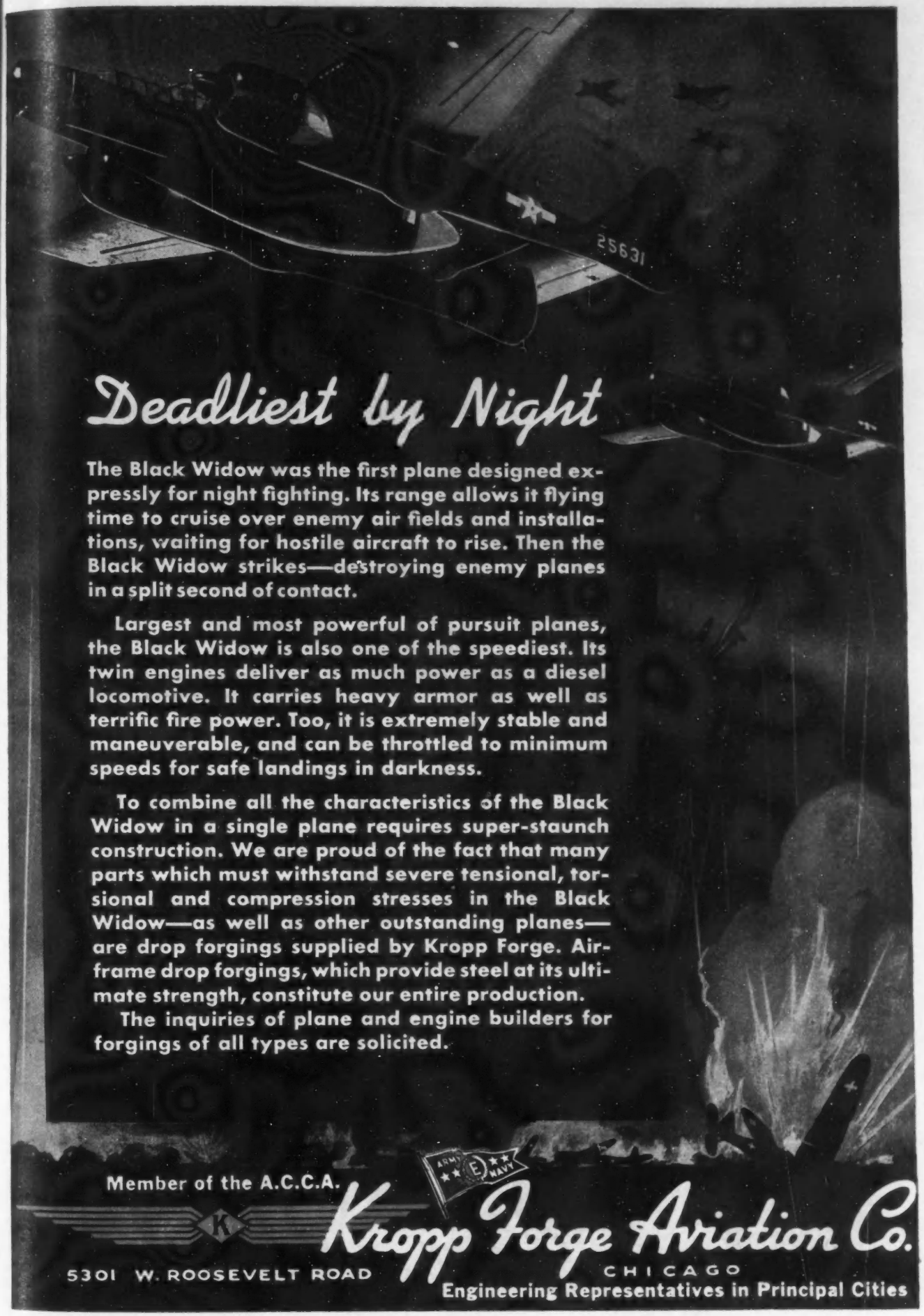
That's a point of fundamental importance to you, for heavy-duty carburetion is a specialized field . . . requiring a set of answers all its own.

Since World War I—since virtually the beginning of the bus and truck industry in this country—Zenith has taken the lead in research, engineering and mass production of advanced-type carburetion *specially built for heavy-duty use.* Today, millions of engines are operating with greater efficiency, greater economy, greater power—thanks to Zenith's specialized knowledge of heavy-duty carburetion.

Make your postwar designs *really postwar* with carburetion as advanced as the equipment you are planning. For authoritative answers and advice, call on Zenith.

Twice tried and proved on the world's toughest proving ground—
WORLD WAR I AND II

ZENITH
CARBURETOR DIVISION OF Bendix AVIATION CORPORATION
DETROIT 14, MICHIGAN



Deadliest by Night

The Black Widow was the first plane designed expressly for night fighting. Its range allows it flying time to cruise over enemy air fields and installations, waiting for hostile aircraft to rise. Then the Black Widow strikes—destroying enemy planes in a split second of contact.

Largest and most powerful of pursuit planes, the Black Widow is also one of the speediest. Its twin engines deliver as much power as a diesel locomotive. It carries heavy armor as well as terrific fire power. Too, it is extremely stable and maneuverable, and can be throttled to minimum speeds for safe landings in darkness.

To combine all the characteristics of the Black Widow in a single plane requires super-staunch construction. We are proud of the fact that many parts which must withstand severe tensional, torsional and compression stresses in the Black Widow—as well as other outstanding planes—are drop forgings supplied by Kropp Forge. Airframe drop forgings, which provide steel at its ultimate strength, constitute our entire production.

The inquiries of plane and engine builders for forgings of all types are solicited.

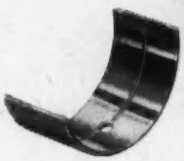
Member of the A.C.C.A.

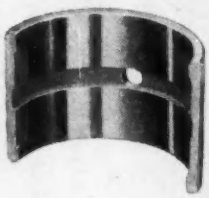
ARMY ★★ E ★★ NAVY

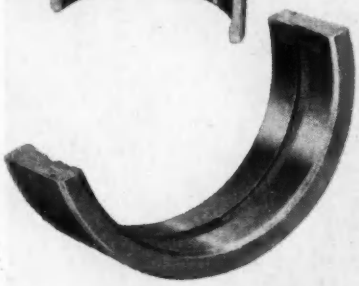
Kropp Forge Aviation Co.

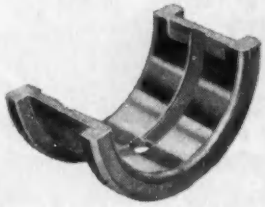
5301 W. ROOSEVELT ROAD CHICAGO

Engineering Representatives in Principal Cities









Leading Diesel Builders Look to Federal-Mogul Silent Sleeve Bearings for Quiet Dependability

On lake and ocean, fishermen stake their success, often their lives, on the dependable operation of their Diesel engines. On American cargo ships around the world, on trucks, in light plants and a growing field of service, Diesels equipped with Federal-Mogul *silent* sleeve bearings are giving this same reliable service. Millions of Federal-Mogul *silent* sleeve bearings bring this same fine performance to the engines of cars, trucks, tractors, planes, pumps, compressors—in fact, wherever shafts turn in sleeve bearings, for 45 years FEDERAL-MOGUL *silent* sleeve bearings have assured quiet, smooth, trouble-free operation.

Because our war manufacture has been the same as our peacetime product, we have almost no reconversion problem and can go directly into normal production. We are already studying many manufacturers' postwar needs. Some production capacity is immediately available for relatively big bearings. Manufacturers of mechanical units using sleeve bearings, quality bushings or similar precision parts are invited to consult us.

FEDERAL-MOGUL CORPORATION, DETROIT 13, MICHIGAN

FEDERAL-MOGUL

Silent FEDERAL Mogul **SLEEVE BEARINGS**

NEW LIFE

FOR YOUR POSTWAR PRODUCTS...

Redmond MICROMOTORS

ADD new life to your products with Redmond Micromotors, built in sizes up to a tenth horsepower.

Add the revealing touch of experience—accomplishment by specialists—the magic of precision on a mass production basis.

Get the exclusive Redmond patents and original Redmond developments. Take advantage of Redmond's 18 active years of effort concentrated on micro-power and its varied applications.

Learn all about these fine Micromotors, their long life, consistently low operating cost, and low first cost. *Write us today.*

Shaded Pole AC Micromotors are built in sizes up to 1/20th horsepower. Series and Shunt Wound DC Micromotors are built in sizes up to 1/10th horsepower for operation at 6 to 115 volts. Micromotors can be tailor-made to meet unusual requirements.

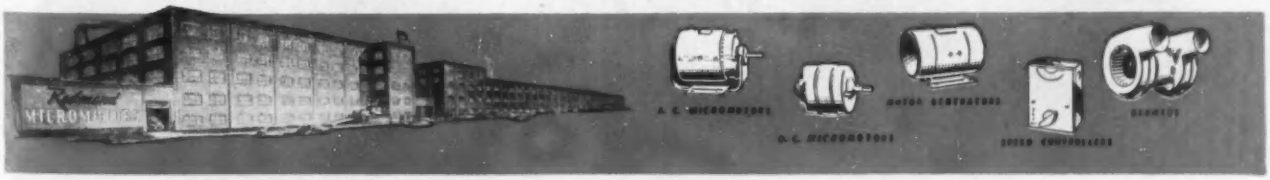
REDMOND KNOWS MOTORS

R REDMOND

A. G. Redmond Company

Composite sketch of Redmond facilities with over 5 acres of floor area.

OWOSSO, MICHIGAN, U. S. A:



War Research by Wausau
● War research by Wausau has developed an advanced art in the design and production of precision piston rings and valve seat inserts.
Our engineers have pursued a relentless research into the new piston ring and valve seat insert problems created by the more efficient wartime engine design and the extensive use of high octane fuel. New rings have resulted — new valve seat inserts have been created including several bi-metal types.
Fifty-one famous builders of engines for fine air craft, motor cars, busses, trucks, tractors, marine and industrial power plants now use Wausau products.
If you have a problem, we invite you to consult our engineering staff. We can help you find the solution.
WAUSAU MOTOR PARTS CO., Wausau, Wisconsin
MAKERS OF FAMOUS OIL-SAVR PISTON RINGS

LADISH

CONTROLLED QUALITY

DROP FORGINGS

up to 2000 pounds

TO MARK PROGRESS

ARMY E NAVY

New techniques in producing heavy drop forgings give more latitude to designers. Our engineers are available now for consultation on your postwar products.

LADISH DROP FORGE CO.

CUDAHY, WISCONSIN • Milwaukee Suburb

Alaska here we come!

YOU won't have to wait for the Alaskan Highway to be smooth-surfaced—if your new postwar car is equipped with HOUDAILLE* HYDRAULIC SHOCK ABSORBERS.

For the Houdaille-equipped car "velvet-paves" the roughest road.

Experience, under war as well as peacetime conditions, has conclusively proved that the answer to shock control is through application of the Houdaille hydraulic principle.

More than ever, in the years to come, Houdaille Hydraulic Shock Absorbers will make the finest cars better, and add countless, velvety miles to their lives.

HOUDE ENGINEERING DIVISION OF
HOUDAILLE-HERSHEY CORPORATION
Makers of Hydraulic Controls
BUFFALO 11, NEW YORK

BUY U. S. WAR BONDS

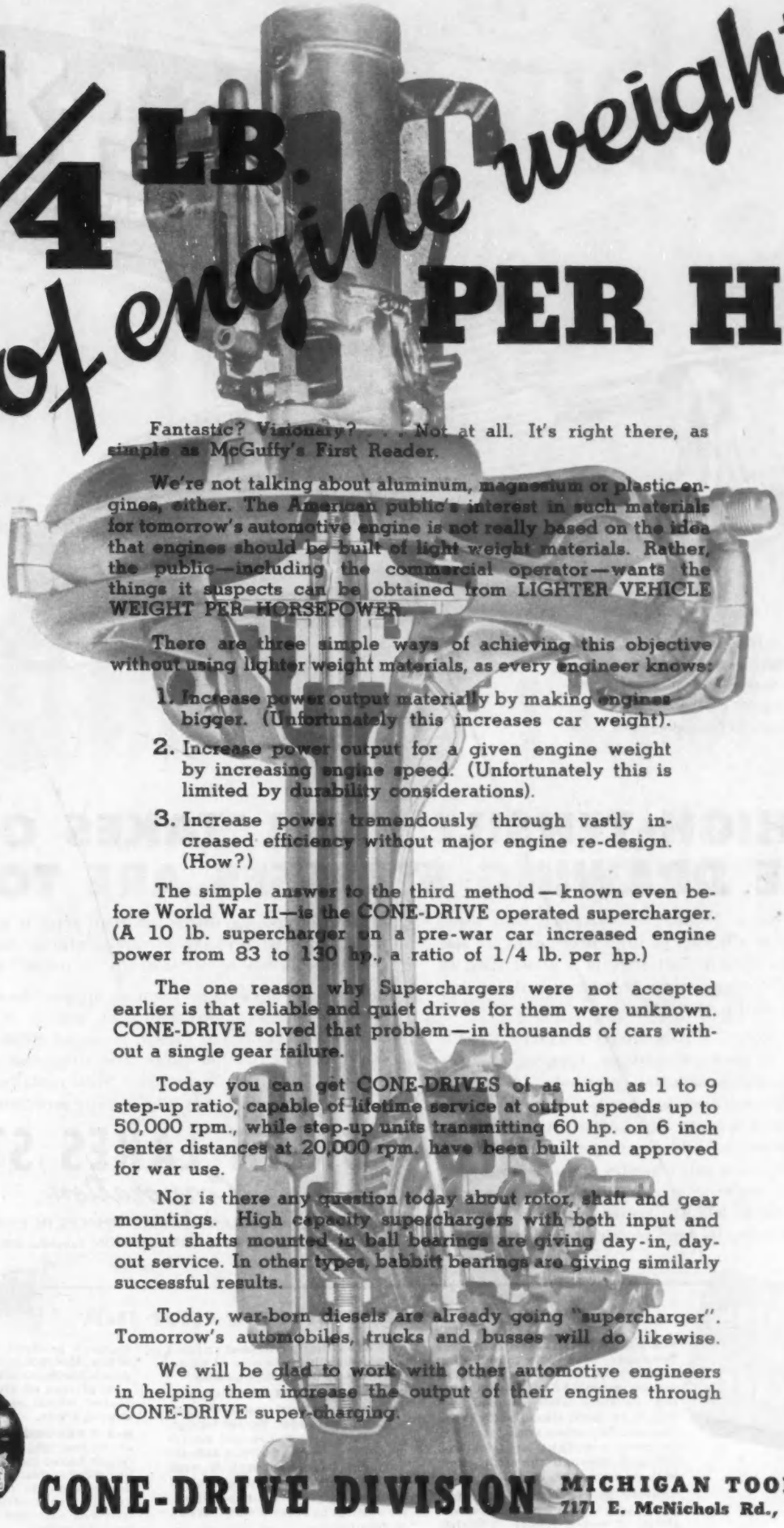
For a smoother ride

HOUDAILLE*

Hydraulic Double Acting

SHOCK ABSORBERS

**Pronounced* "HOO-DYE"*



1/4 LB. of engine weight PER HP

Fantastic? Visionary? . . . Not at all. It's right there, as simple as McGuffy's First Reader.

We're not talking about aluminum, magnesium or plastic engines, either. The American public's interest in such materials for tomorrow's automotive engine is not really based on the idea that engines should be built of light weight materials. Rather, the public—including the commercial operator—wants the things it suspects can be obtained from LIGHTER VEHICLE WEIGHT PER HORSEPOWER.

There are three simple ways of achieving this objective without using lighter weight materials, as every engineer knows:

1. Increase power output materially by making engines bigger. (Unfortunately this increases car weight).
2. Increase power output for a given engine weight by increasing engine speed. (Unfortunately this is limited by durability considerations).
3. Increase power tremendously through vastly increased efficiency without major engine re-design. (How?)

The simple answer to the third method—known even before World War II—is the CONE-DRIVE operated supercharger. (A 10 lb. supercharger on a pre-war car increased engine power from 83 to 130 hp., a ratio of 1/4 lb. per hp.)

The one reason why Superchargers were not accepted earlier is that reliable and quiet drives for them were unknown. CONE-DRIVE solved that problem—in thousands of cars without a single gear failure.

Today you can get CONE-DRIVES of as high as 1 to 9 step-up ratio, capable of lifetime service at output speeds up to 50,000 rpm., while step-up units transmitting 60 hp. on 6 inch center distances at 20,000 rpm. have been built and approved for war use.

Nor is there any question today about rotor, shaft and gear mountings. High capacity superchargers with both input and output shafts mounted in ball bearings are giving day-in, day-out service. In other types, babbitt bearings are giving similarly successful results.

Today, war-born diesels are already going "supercharger". Tomorrow's automobiles, trucks and busses will do likewise.

We will be glad to work with other automotive engineers in helping them increase the output of their engines through CONE-DRIVE super-charging.

CONE-DRIVE

CONE-DRIVE DIVISION **MICHIGAN TOOL COMPANY**
7171 E. McNichols Rd., Detroit 12, U.S.A.

Automobile bumpers, cold-formed from N-A-X HIGH-TENSILE STEEL, illustrate the ability of this fine alloy to take the stresses of a critical cold-stamping operation. Result: a tougher, more satisfactory product at reduced fabricating costs.

THIS HIGH-TENSILE STEEL "TAKES OVER" WHERE DRAWING STRESSES ARE TOUGH

N-A-X HIGH-TENSILE STEEL has stepped into some tough spots in the production of intricate shapes. It has proved to production men that here is a great steel to work with, from the standpoints of both manufacturing operations and finished performance.

To put it in a few words, N-A-X HIGH-TENSILE STEEL has what it takes to make a stronger, tougher product through more efficient production methods. Its exceptional ductility and resistance to impact, inherent in the fine grain structure of a great alloy, often make possible the speed and economy of cold-forming on pieces which must be worked hot when other grades of steels are used. And where critical drawing stresses require hot work, N-A-X HIGH-TENSILE STEEL provides the important advantage of maintaining its high physical properties with minimum cooling distortion even after it has been subjected to a wide range of temperatures. No subsequent treatment is needed to maintain "as rolled" specifications.

Add to these advantages the high fatigue life and resistance to corrosion and abrasion that qualify N-A-X HIGH-TENSILE STEEL for varied types of applications, and you'll see why this fine-grain, low-alloy steel is a factor in postwar planning. Great Lakes Steel metallurgical service is yours on request: Let's have your problem.

GREAT LAKES STEEL
Corporation

DETROIT 18, MICHIGAN • SALES OFFICES IN PRINCIPAL CITIES
Division of NATIONAL STEEL CORPORATION. Executive Offices, Pittsburgh, Pa.

GREAT STEEL FROM GREAT LAKES

HIGHLIGHTS OF N-A-X ALLOY STEEL

N-A-X HIGH-TENSILE STEEL compares favorably with other low-alloy high-tensile steels in yield and tensile strength, with outstanding ductility and notched bar values. In applications where it replaces mild-carbon steels, it serves to reduce weight or increase strength through the utilization of these properties in design.

Another property that may interest you is the excellent weldability of N-A-X HIGH-TENSILE STEEL—whether welded to itself or to other high-tensile or structural steels of welding quality.

N-A-X 9100 SERIES STEELS are produced in carburizing and constructional grades. Except for carbon, they have a chemical analysis that is constant within definite ranges. Together with X-9100 Series steels, containing molybdenum, they provide hardenability ratings to cover a wide variety of requirements, yet give an all-purpose analysis to yield properties. Molybdenum confers great depth hardenability to extend the usefulness of the N-A-X 9100 Series, which are medium-hardening steels.

N-A-X ARMORPLATE is an example of the exacting requirements that Great Lakes can meet with this low-alloy series. One of the X-9100 Series steels is the basis of the armor we produce for tanks, armored cars and practically all landing craft.

It's Houdry and TCC that are setting the records!

First in Volume—Houdry and TCC units represent nearly two-thirds of the world's total* catalytic cracking capacity and have supplied all but a minor percentage of the United Nations entire war requirements of catalytic aviation fuel.

First in Quality—The highest-octane catalytic cracked aviation base stock being produced anywhere in the world in one pass comes from Houdry-licensed plants.

Houdry licensees will enter the post-war competition for motor fuel markets well armed. The proved efficiency of their processes is enhanced by the sustained engineering support of Houdry Laboratories, which make available improved operating techniques as well as pilot-plant evaluation of crude stocks to assure maximum yields.

*Includes capacity now serving the war program by improving aviation fuel quality through retreating.

HOUDRY PROCESS CORPORATION
WILMINGTON, DELAWARE

Houdry Catalytic Processes and the TCC Process are available through the following licensing agents to all American refiners, subject to approval by the United States Government.

BECHTEL-McCONE CORP. Los Angeles, Calif.
THE LUMMUS COMPANY New York City, New York
E. B. BADGER & SONS CO. Boston, Massachusetts

HOUDRY CATALYTIC PROCESSES
... FOR VICTORY IN WAR ... FOR PROGRESS IN PEACE

Illustration from Inland Poster showing operation in the production of the Inland-made carbine

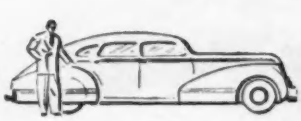
The remarkable effectiveness of the Inland-made Carbine—the light, maneuverable and deadly accurate little .30 caliber gun—has been proved in every theater of war.

Yet, when the war began it was only a design which normally would have been years away from finished production.

Inland's resourcefulness in carrying the Carbine from design to quantity manufacture in record breaking time has been widely recognized. In fact, the Carbine has been called one of the outstanding Ordnance developments of the war.

The Carbine is one of many Inland products for Victory, whose efficient high speed production has demonstrated the value to America in war, as in peace, of Inland's years of engineering enterprise and manufacturing versatility.

INLAND MANUFACTURING DIVISION, *General Motors Corporation,* DAYTON, OHIO

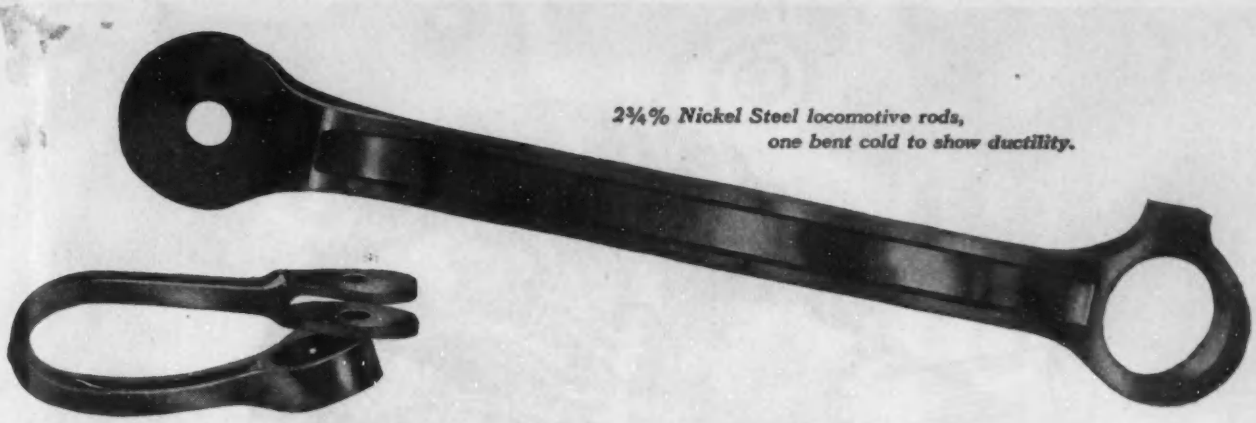


INLAND

INLAND *Manufacturing*

RUBBER, METAL, PLASTICS

Inland Products for Victory include Carbines, Tank Tracks, Gun Sights, Helmet Liners, Extinguisher Horns, and Rubber, Synthetic Rubber and Metal Parts for Tanks, Aircraft, Submarine Chasers, Torpedo Boats, Artillery Lighters and Landing Craft.



2¼% Nickel Steel locomotive rods, one bent cold to show ductility.

QUENCHED AND TEMPERED

NICKEL STEEL

FORGINGS COMBINE

EXCEPTIONAL DUCTILITY WITH HIGH TENSILE STRENGTH

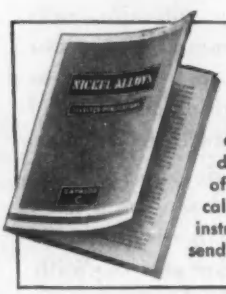
Composition and Typical Properties of Normalized Quenched and Tempered 2¼% Nickel Steel Rods

Description or Size	Melt Yield Pt. No. #s per Sq. In.	Tensile Strength #s per Sq. In.	Elong. % in 2 In.	Reduction in Area %	ANALYSIS					
					Car.	Mang.	Phos.	Sul.	Sil.	Ni
Main Rod....	92900	110000	25.0	64.4	.31	.78	.027	.026	.25	2.75
Main Rod....	86500	104500	25.5	65.6	.32	.86	.034	.032	.29	2.69
Main Rod....	86360	104400	26.0	64.8	.32	.86	.034	.032	.29	2.69
Main Rod....	87850	102350	26.0	66.2	.31	.89	.037	.025	.32	2.69
Front Rod....	86000	102250	25.0	67.3	.29	.82	.035	.027	.24	2.71
Front Rod....	83900	104250	25.0	66.1	.29	.82	.035	.027	.24	2.71
Front Rod....	86850	104250	27.0	66.1	.32	.86	.035	.025	.30	2.65
Front Rod....	89500	107050	25.5	65.6	.32	.86	.035	.025	.30	2.65
Back Rod....	89500	107650	25.0	62.7	.30	.79	.030	.025	.22	2.71
Back Rod....	87500	106450	25.0	65.4	.29	.82	.035	.027	.24	2.71
Back Rod....	87000	105600	25.0	65.4	.29	.82	.035	.027	.24	2.71
Back Rod....	88150	104850	26.0	66.8	.29	.82	.035	.027	.24	2.71

Specimens Taken from Mid-Section of Prolongations of the Forgings

The above table compiled by the American Locomotive Company shows the chemical compositions and mechanical properties of some normalized, quenched and tempered nickel steel front, main and back rods recently produced as replacement rods for locomotives being speeded up and rebalanced. These values are typical of replacement rod forgings recently tested by that company.

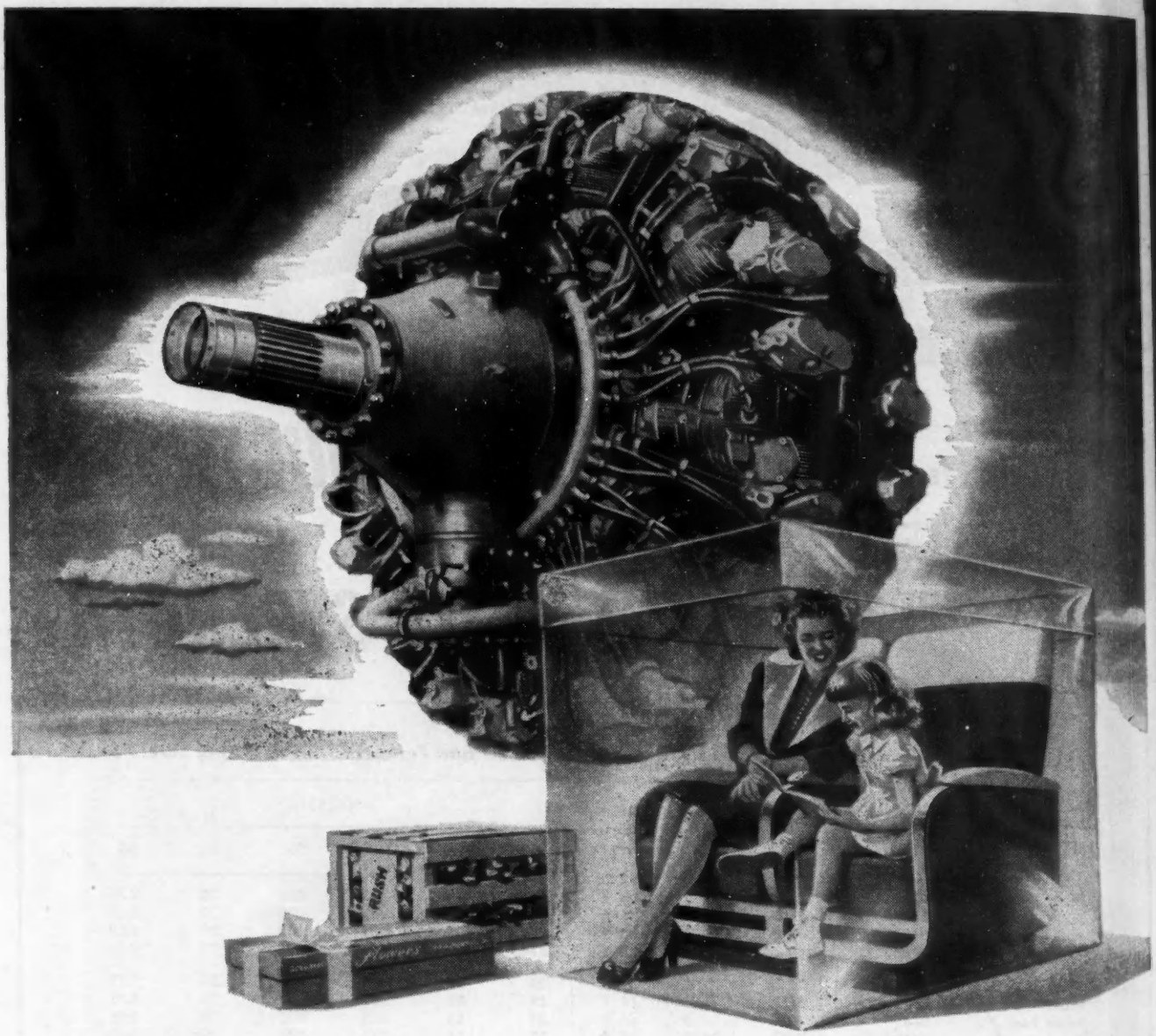
Quenched and tempered nickel steel forgings provide high tensile strength and ductility, combined with unusual toughness and high fatigue strength—qualities which tend to obviate breakage and assure long, trouble-free service when employed in heavy duty machinery and equipment.



Catalog "C" makes it easy for you to get booklets and bulletins on industrial applications of Nickel, metallurgical data and working instructions. Why not send for your copy today?

★ Nickel ★

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall Street, New York 5, N. Y.*



Faster and Fresher via Cyclones

Transportation of perishables by air becomes a highly interesting prospect as ton-mile costs shrink. Yet no commodity under consideration is so perishable as human vitality, which on extended trips wilts like lettuce or gardenias.

Faster, Cyclone-powered air transport gives passengers a wide travel advantage in distance covered before fatigue sets in. With still higher standards of commercial speed in sight for tomorrow, transportation to any part of the world will be possible with maximum saving of passenger vitality.

The accepted high-power engine for super-speed transport in such installations as the Boeing Superfortress, Lockheed Constellation, Curtiss CW-20E Commando and Martin Mars is the Cyclone 18, with a rating of more than 2200 horsepower. True to Wright tradition, the smooth-running Cyclone 18 is thrifty of fuel and maintenance, and offers operators a payload bonus of two extra passengers over comparable power plants.

Wright Cyclones pay their way.

Cyclones Save 3 Ways

LESS WEIGHT—MORE PAYLOAD
LOWER FUEL CONSUMPTION
REDUCED MAINTENANCE

WRIGHT

Aircraft Engines

Wright Aeronautical Corporation
A Division of Curtiss-Wright Corporation
Paterson, New Jersey, U.S.A.

WRIGHT POWERS THE TONNAGE OF THE AIR

Standard Designs Give Constant Velocity up to 38° Maximum Angularity

New Process TRACTA JOINT

. . . the High Efficiency Universal that's easier to assemble and disassemble

Product of the automotive talent of two nations, the **TRACTA** constant velocity universal joint is outstanding for:

1. Constant velocity over wider angles—up to 38° in standard models, up to 45° in special models.
2. Extreme simplicity, **ONLY FOUR PARTS.**
3. Ease of assembly and disassembly, no tools, gages or pre-loading.
4. High efficiency with low friction losses.
5. No brinelling, wide bearing surfaces reduce unit loads.
6. Ability to function even if original alignment is disturbed.
7. More—the standard **TRACTA** joint permits end-float of a magnitude sufficient for most applications.

TRACTA JOINTS are especially suited to front-wheel drives, multiple-drives, independently-sprung wheels, railroad inter-car drives, machine tools, conveyors, dynamometers, power take-offs, long and short coupled pump drives, marine and aircraft applications. Write for sizes, torque capacities, operating and test data.

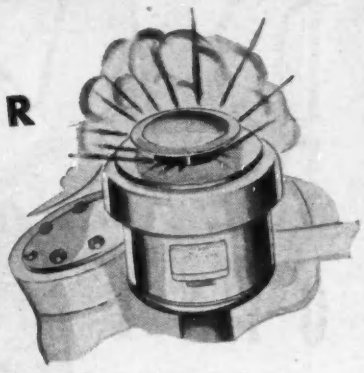
When the front wheels swerve, and the rear wheels drop into a shell hole, that's when the easy steering, uniform traction and sturdiness that the New Process Tracta Joint affords, are all important. These joints are one of the reasons why U. S. Army jeeps are able to negotiate muddy and shell torn terrain. (Signal Corps Photo.)

New Process GEAR CORPORATION

Differentials, Axles, Transmissions . . . Aviation Gears
SYRACUSE 1, N. Y.

THIS AIR FILTER

Saves itself



. . . Another example of Air-Maze engineering

When gas engines backfire, the force of gases rushing out through the air intake is tremendous. So great, in fact, that an ordinary air filter might be blown hundreds of feet away. To overcome this dangerous condition, Air-Maze engineers have incorporated a *backfire relief valve* as an integral part of their oil bath filters to permit rapid escape of backfire gases.

You may never require a filter for a gas engine, but you can obtain the same advantages of *engineered air filtration* in every Air-Maze air filter. Whether your interest in air filters applies to air conditioning, ventilating, compressors, blowers or engines, remember — "if it uses air, use AIR-MAZE".

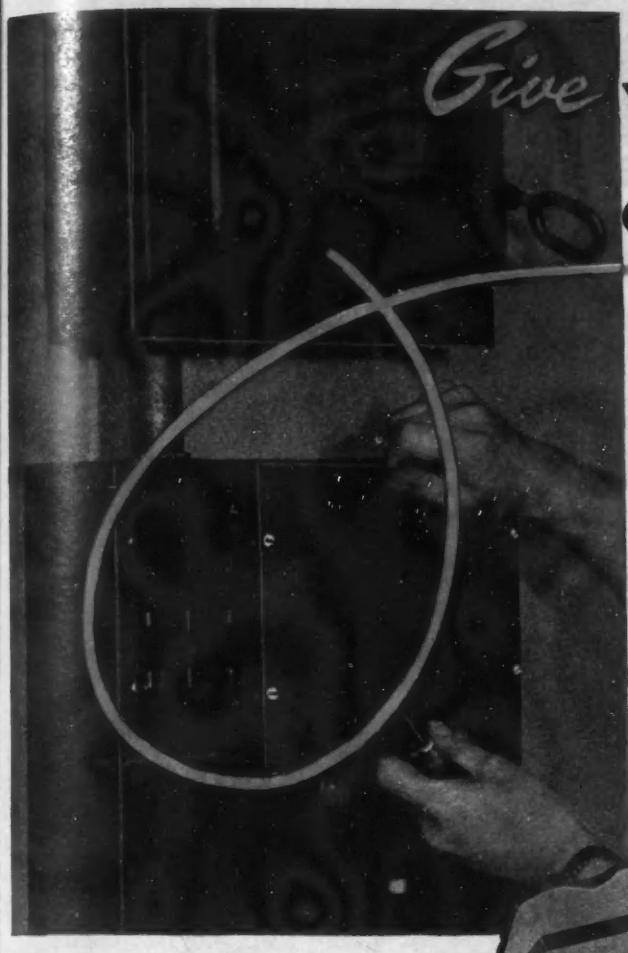
AIR-MAZE CORP. • CLEVELAND 5, OHIO

Representatives in Principal Cities. In Canada: Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor; Fleck Bros., Ltd., Vancouver

IF IT USES AIR...USE

AIR-MAZE

ENGINEERED AIR FILTRATION



Give YOUR PRODUCT THIS POWERFUL *Selling Feature!*

SHAKEPROOF WILL HELP YOU ENGINEER YOUR PRODUCT TO INCLUDE FASTER OPENING AND CLOSING!

Shakeproof Quick Fasteners will definitely provide your product with extra utility, and thus assure complete user satisfaction. They permit extra-fast opening and locking of covers, doors, and panels. Just about ¼ turn of a screwdriver, and the fastener *opens* . . . another ¼ turn *locks* it securely, assuring absolute protection againt the most severe vibration.

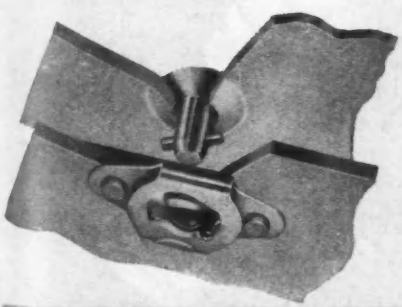
Shakeproof Quick Fasteners can be designed into your product . . . and a Shakeproof Engineer will recommend the best methods for installation and assembly. This specialized engineering service will greatly help you . . . it is offered without obligation. Write today—a field engineer will contact you for immediate consultation!

This electrical fuse box is one of many practical applications for Shakeproof Quick Fasteners. Specially designed for aircraft, this new locking principle will assure your product of better performance!

SHAKEPROOF *Quick* FASTENERS

(Known in the Aviation Industry as "Cowl" Fasteners)

Shakeproof Quick Fasteners are comprised of only 3 parts —spring unit, stud, and cross pin. Spring units are designed for use on metal, wood, or plastics. Studs are available in oval, flush, or wing type. Complete assemblies are offered in 3 sizes. Write today for Catalog AD2, giving complete specifications and details!



ARMY E NAVY

SHAKEPROOF inc.

"Fastening Headquarters"

Distributor of Shakeproof Products Manufactured by ILLINOIS TOOL WORKS

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Other Shakeproof Products include:

Shakeproof Lock Washers with Exclusive Tapered-Twisted Teeth	Shakeproof Type 1 Thread-Cutting Screws for Metals	Shakeproof Type 25 Thread-Cutting Screws for Plastics	Semi Fastener Units Pre-Assembled Shakeproof Lock Washer and Screw

X= AlSiMag

TRADE MARK REGISTERED U. S. PATENT OFFICE

THREADED CORES

"X" is usually the unknown; but to leading manufacturers of industrial heating equipment the dependability of AlSiMag threaded cores is well and favorably known

WHERE?

Immersion heaters, Radiant heating units, Slide-bar rheostats, Machine-bolt assembly heaters, Instrument heaters, Soldering Irons, Warm-air fans.

What's yours?

WHY?

AlSiMag threaded cores resist high temperatures. They are uniform in size, mechanically rugged. A variety of ceramic bodies permits selection of the most suitable material for the job.

Send for property charts describing AlSiMag for threaded cores.

ALCO has been awarded for the fourth time the Army-Navy "E" Award for "continued excellence in quantity and quality of essential war production."

AMERICAN LAVA CORPORATION

CHATTANOOGA 5, TENNESSEE

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Electrical
Wire AND Cable

Wide Range of Types

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Precision-Made to fit your wiring job

The question faced by every user of electrical wire and cable is: What is the specific job, what are the special qualities needed? The answer can be readily found at Auto-Lite.

Auto-Lite engineers will be glad to help you determine just what size, type and shape of wire you need, what material to use and what insulation. Auto-Lite research has anticipated the problem, has engineered the solution. The manufacturing facilities in the big Auto-Lite plant are diverse enough to furnish the kind and quantity of electrical wire and cable you need. Address your inquiries to

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SARNIA, ONT. *Wire & Cable Division* PORT HURON, MICH.

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FLEX-O-TUBE *Detachable* HOSE FITTINGS

CHOSEN FOR
REPLACEMENT
ON ALL
MILITARY VEHICLES
A complete assortment of replacement patented hose fittings packaged in the type of kit here illustrated and Style No. 7530 hose lines are furnished by Flex-O-Tube to all supply units all over the globe for use on the fuel and oil lines of all U. S. administrative and tactical vehicles (buses, cars, trucks, jeeps, ambulances, etc.)
They are being used from the steaming jungles of Burma to the frozen tundra of the Aleutians, and for use with all types of fuel including aromatic fuels.
Total production now being used by the armed forces — will later be available when the military situation permits.
FLEXIBLE HOSE and ATTACHABLE, RE-USABLE COUPLINGS
MAKE-UP SPECIFICATION MANUAL

THE **Flex-O-Tube** COMPANY

LAFAYETTE at 14th AVE.,
DETROIT 16, MICHIGAN
Offices: CHICAGO · FORT WORTH
LOS ANGELES · NEW YORK
SEATTLE · TORONTO, ONT.

WHERE WILL THE MONEY COME FROM TO MAKE HIS AMBITIONS COME TRUE?

YOU'LL find an important part of the answer in *rural America* . . . and the towns and small industry that are a part of the warp and woof of it!

There you'll find the fertile soil that will nourish the enormous purchasing power America must have to make our soldiers' ambitions come true.

All America . . . and American Industry in particular . . . has a stake in its continued well being.

Does this mean that sub-contracting so vital to the accomplishment of the miracle of American War Production is to be a factor of Post-War Production?

Will sub-contracting result not only in spreading the purchasing power but in providing a more efficient manufacturing procedure which in turn will make available more and better goods to more people?

As sub-contractors . . . as an organization located in one of America's smaller communities in the heart of the Middle West . . . to us, the answer is plain.

It is YES.

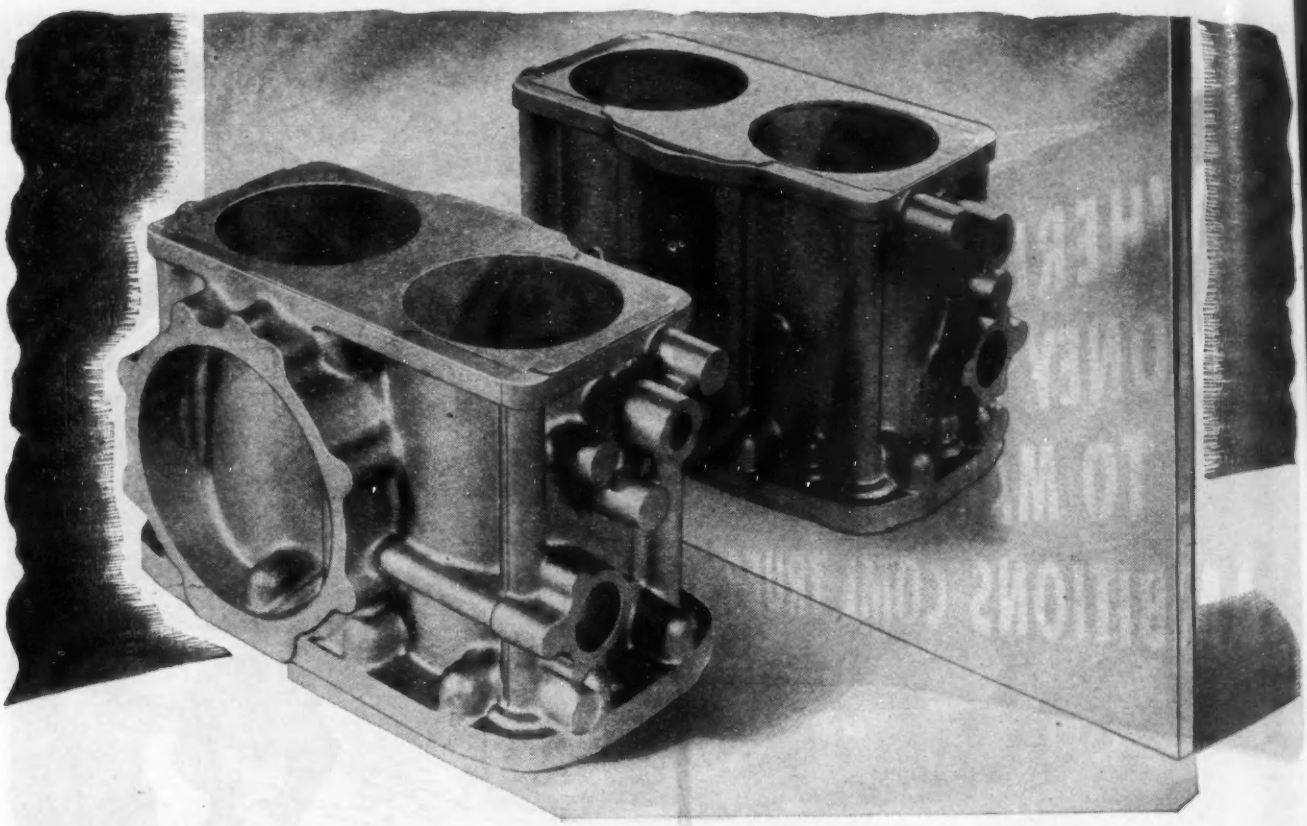
And while we of American Industry are now putting plans into action to make the miracle of post-war production come true . . . let us redouble our efforts in support of War Bond Sales whose essentiality for financing the war and providing an important base for post-war purchasing power is recognized by all of us.

★

This message is published in the interest of War Bond Sales and a prosperous post-war America of Free Enterprise by Burgess-Norton Mfg. Co., the services of whose Engineering staff, Metallurgical and Research Laboratories are available now to the manufacturers who will require piston pins, screw machine parts, heat treated and ground steel products, hydrogen copper brazing, non-precision ball bearings and related fabricated steel products.

Burgess Norton
MANUFACTURING COMPANY
40 years in GENEVA, ILLINOIS

A Part is Never Made Right unless it is Satisfactory to Our Customers



With Permite PERMANENT MOLD Castings the MILLIONTH is the image of the FIRST

★ TURN OUT a million Permite Aluminum Alloy Castings by the permanent mold process, and the millionth will not only **look** like, but it will **be** like the first. For the permanent mold casting method employs the same metal mold for every casting poured. Dimensional variations in the castings are entirely eliminated.

Permite Permanent Mold Castings also duplicate your design with greater precision than sand castings. The rigid metal mold shapes castings accurate to ± .010". (Accuracy to ± .030" is standard with sand castings.) And greater tensile strength is produced by the more rapid cooling inside metal walls.

As a result of permanent mold precision, you have less metal to remove. Often, you have fewer surfaces to finish. You may be able to specify thinner cross-sections, saving metal and weight.

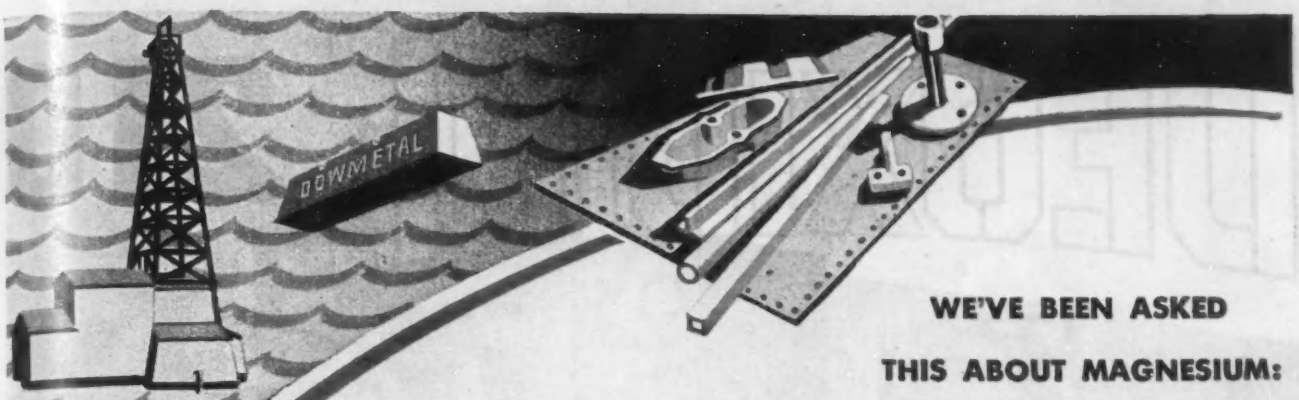
Aluminum Industries has been making permanent mold aluminum castings for nearly 25 years. To our casting experience we add a thorough knowledge of aluminum and its alloys.

Our engineers will be glad to make recommendations on how Permite Permanent Mold Aluminum Castings may help you reduce your production costs. Submit your requirements without obligation.

ALUMINUM INDUSTRIES, Inc.
CINCINNATI 25, OHIO

Chicago: 616 South Michigan Ave.
Detroit: 809 New Center Building
Los Angeles: 324 North San Pedro St.
New York: 9 Rockefeller Plaza

PERMITE ALUMINUM ALLOY CASTINGS



WE'VE BEEN ASKED

THIS ABOUT MAGNESIUM:

How complete are Dow services for the magnesium user?

Dow is the pioneer and major producer of magnesium . . . the principal developer of its alloys and fabrication techniques . . . and the leading sponsor of its widespread application in many fields of industry. So it is only logical to consult Dow relative to any phase of the usage of the lightest of all structural metals.

- Forgings
- Dowmetal Magnesium Alloy Ingots
- Extrusions: Bars, Rods, Tubing, Special Shapes
- Sand Castings, Permanent Mold Castings, Die Castings
- Construction of Welded and Riveted Subassemblies
- Sheet, Plate and Strip
- Technical Service

The broad range of Dow magnesium activities *begins* with the extraction in large quantity of the virgin metal from Michigan brine and from the waters of the sea . . . it *includes* production of a complete line of Dowmetal Magnesium Alloy ingots and an accompanying line of fluxes and protective agents . . . it *extends* to complete mill and foundry facilities for cast and wrought products and a jobbing fabrication shop for stamping, drawn parts and assemblies . . . all *supplemented* with the knowledge accumulated in 28 years of experience in engineering and metallurgical research.

Thus Dow's pre-eminent position in the magnesium field makes it exceptionally well qualified to work with you in any development where the high strength-weight ratio of a metal is valuable.

DOWMETAL *magnesium*

THE METAL OF MOTION

MAGNESIUM DIVISION • THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

DEOXIDINE 210

Cleans and Conditions Ferrous Products for Durable Paint Finish

TO MEET ORDNANCE SPECIFICATIONS

DEOXIDINE 210 not only cleans efficiently, but at the same time properly conditions the metal surface to meet the exacting requirements of Army Specifications AXS-1245 (Grade 1) Finish (when used as directed in ACP Technical Service Data Sheet No. 3-2-210-2.)

The ability of this phosphatic material to properly condition the surface of the many ordnance parts, at the same time it removes cutting oils, simplifies the equipment required. A three stage power washer is all that is needed to simultaneously *complete* both *cleaning* and *conditioning* operations. The equipment may be constructed of mild steel throughout—stainless steel is not required.

Large volume production of large or small work can be handled continuously and rapidly by the effective **DEOXIDINE 210** process. The simplicity and efficiency of this process adapts it, not only to the cleaning and conditioning of present war materials, but also to the cleaning of postwar metals as well.

The detergent properties of **DEOXIDINE 210** are superior to alkali cleaners in most instances and the surface produced greatly improves paint adhesion and durability.

There are other types of DEOXIDINE suited to varying requirements in metal cleaning and for application with brushes or in immersion tanks as well as spraying in power washers.

The experience of ACP Technicians is at your service to recommend the DEOXIDINE and method of application best suited to your needs.

CHEMICALS ACP PROCESSES

Manufacturers of Inhibitors & Metal Working Chemicals

AMERICAN CHEMICAL PAINT CO.
AMBLER ACP PENNA.

Note: West Coast Plants may address inquiries and orders for prompt delivery to: Leon Finch, Ltd., 728 East 59th St., Los Angeles, Calif.

American Chemical Paint Company, Ambler, Pa.
Please send me general Technical Service Data Sheets on

☐ Deoxidine ☐ Deoxylyte

*Name*_____ *Title*_____

*Company*_____

*Address*_____

I-12

MERCHANDISE IS ON THE MARCH

Hats off to that valiant army of commercial truckers whose efforts to supply the home front have eased the sting of wartime shortages ★ But for the never-say die philosophy of this organization and the recognized stamina of the finest rolling stock in the world, this country would have been faced with a condition which, by comparison, would have dwarfed our current inconveniences ★ We, of Bendix-Westinghouse, are not without pride for the heavy role Air Brakes and Pneumatic Controls have played in this Victory on the home front. More especially, we are grateful for those countless, unsolicited statements from operators who credit Bendix-Westinghouse Equipment for a major share of their accomplishment in keeping units rolling, safely, efficiently and economically ★ Naturally, in view of the record, you will be interested in the many exclusive advantages this world standard of safety holds for you. To relay this information, a nationwide chain of Bendix-Westinghouse Distributors is waiting and ready to survey your individual control requirements.

BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE COMPANY . . . ELYRIA, OHIO

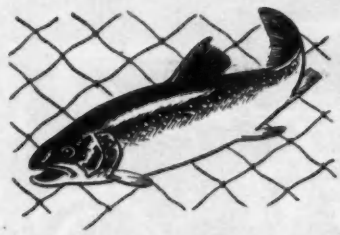
Bendix-Westinghouse

AIR BRAKES

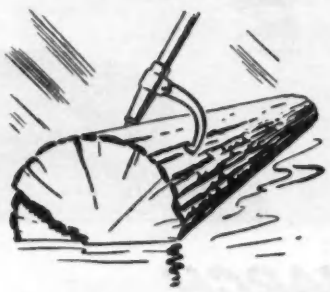
AND PNEUMATIC CONTROL DEVICES

IT IS SIGNIFICANT THAT AMERICA'S FINEST MOTOR TRUCK FLEETS ARE EQUIPPED WITH BENDIX WESTINGHOUSE AIR BRAKES

In the "mining" of petroleum, as in the mining of many other ores and the production of aggregates, Cummins Dependable Diesels play a vital role. They power drilling rigs, trucks, shovels, dredges and many other types of equipment . . . have established an enviable record for reliable, low-cost performance on the toughest 24-hour-a-day jobs.



America's commercial fishing boats are bringing in record catches to meet record war-time requirements for fish and fish by-products. Many of these boats are Cummins Diesel-powered because fishermen everywhere know that the best assurance of being "first out and first back" is a Cummins Marine Diesel.



Basic in war and basic in peace is the vast logging industry of the Northwest. Here, the performance of Cummins Dependable Diesels in yarders, loaders, trucks and tugs explains why Cummins Diesel power is known among loggers as "the power behind CHEAP LOGS."

In agriculture and its many allied industries, Cummins Diesel power has innumerable applications. It is widely used in the West for irrigation purposes . . . in cotton gins, flour and feed mills, ice plants, dairies and many other places where its economy and dependability have been instrumental in increasing production and also decreasing costs.

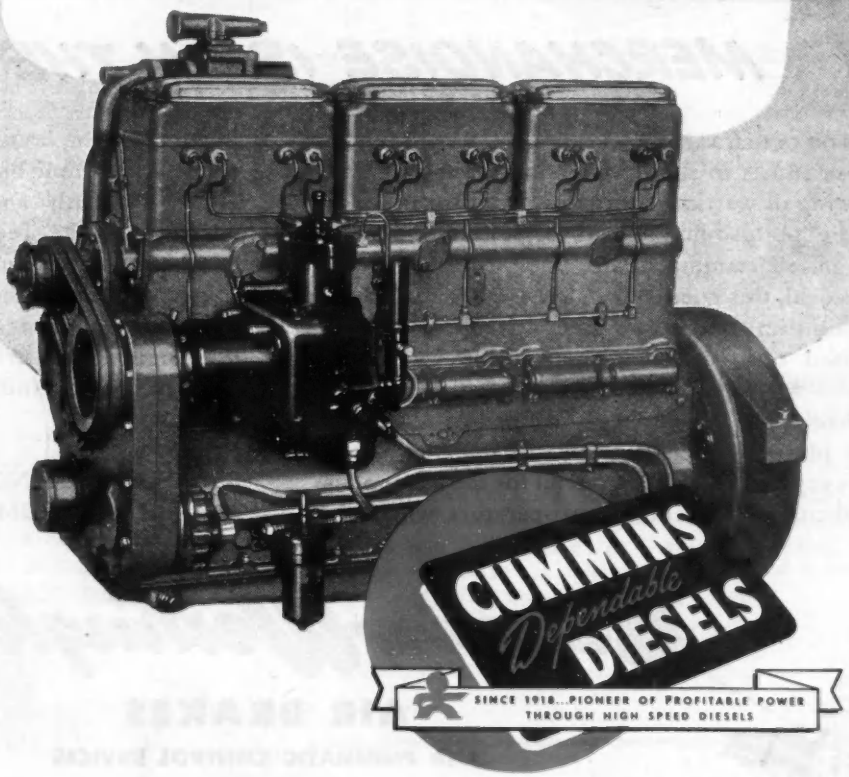
Automotive models • marine engines for propulsion and auxiliary power • power units of all types • stationary engines • generating sets • locomotive models.

Backbone of every Basic Industry

In the "mother" or basic industries which produce the raw materials—agriculture, mining, commercial fishing and logging—and in the countless allied industries that play a part in the conversion of raw material into finished product, the development of the high speed diesel in 1932 went a long way toward changing modern concepts of power.

This diesel was a Cummins Diesel. Once and for all it struck away the shackles of excessive weight and size which had so long limited the use of diesel power. Once and for all it proved that diesel power could be applied to virtually any heavy-duty job and do that job—cheaper, faster, longer.

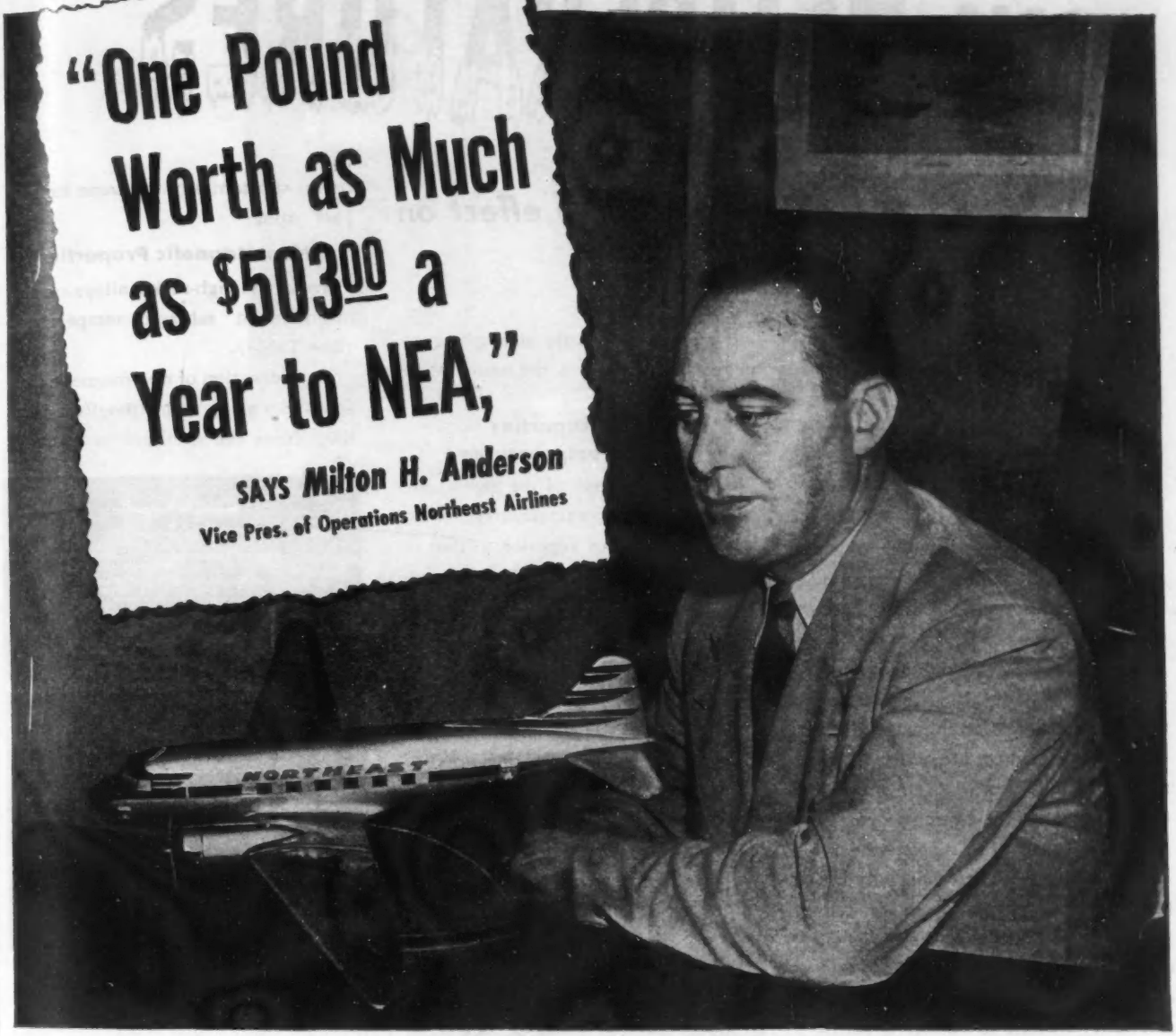
Since 1932, continued refinements in every phase of design, construction and material specification have produced still further improvements in the Cummins Diesel's operating economy . . . still further reductions in its weight and dimensions per horsepower. That's why operators and builders of all types of powered equipment—automotive, industrial and marine—have turned to Cummins for the dependable, low-cost power which is the backbone of industry. CUMMINS ENGINE COMPANY, INC., Columbus, Ind.



"One Pound Worth as Much as $503.00 a Year to NEA,"

SAYS **Milton H. Anderson**

Vice Pres. of Operations Northeast Airlines



"Our experience in New England over a period of years emphasizes the value of every pound of increased pay load. Each pound of unnecessary weight saved can mean that much more for passengers and cargo. For example, one pound of excess weight on the Boston-New York run, operated with 24-passenger DC-3's on hourly schedules, could cost Northeast as much as $503.00 a year."

Boots Nuts Save Up to 60 Lbs. Per Plane

- Lighter, tougher, Boots step up cargo capacity.
- Meet all specifications of government aviation agencies.
- Standard fastenings on all post-war commercial ships.
- Wartime standard nuts on all types of planes—fighters, bombers, transports.
- Can be used again and again—yet self-locking grip never slips.
- "Outlast the plane."

Motion Picture—"All Work And NoPlay"—16 mm. sound—30 minutes. Write for information.

BOOTS STEEL ANCHOR NUT

(W2S #8-32) The comparable fibre nut is 151.2% heavier than this all-metal, steel self-locking nut.

Send for Free Weight-Saving Booklet

Actual weights of over 250 different self-locking nuts used in aircraft, comprehensively reviewed for the convenience of aircraft designers, engineers operating and maintenance personnel. Copy will be sent you, free, on request.

BOOTS SELF-LOCKING NUTS

"They Fly With Their Boots On—Lighter"

Boots Aircraft Nut Corporation, General Offices, New Canaan, Conn., Dept. R

Representatives in New York • Chicago • Detroit • Indianapolis • Los Angeles • Kansas City • Dallas • Toronto • Montreal • Vancouver

LOW TEMPERATURES

...and how their embrittling effect on metal parts can be avoided

Today, when choosing a metal for critical aircraft applications, a new factor must be considered...

The effects of intense cold on its properties.

The most common trouble comes, of course, from *brittleness.*

To avoid it, metals need high ductility and toughness, not only at ground-level temperatures but in the sub-zero cold of the sub-stratosphere.

As this ductility and toughness, in turn, must usually be coupled with other properties of strength, hardness, corrosion-resistance, etc., the problem resolves itself into finding a material that combines *all* the desired properties.

This is exactly the reason why the INCO Nickel Alloys are especially useful for parts to withstand sub-zero temperatures. In addition to their strength and resistance to corrosion, these metals exhibit a unique and valuable characteristic: *Instead of becoming brittle they retain their high toughness values as their strength and hardness increase.*

This is in marked contrast to the results observed with many other engineering materials which, while retaining reasonable tensile strength, grow increasingly brittle as the temperature drops.

High Properties at Low Temperatures

The tensile strength of the high-nickel alloys at normal temperatures, for instance, is equal or superior to that of many steels. This strength and hardness actually increase as the temperature skids down into the sub-zero range. (See table below).

The important factor of *freedom from brittleness* is illustrated by the results of Charpy impact tests. Here, the normally high impact strength of nickel at ordinary temperatures actually increases an average of 10% at −110° F. Inconel loses slightly in ductility, but both Monel and "K" Monel retain substantially the same high impact rating.

Non-Magnetic Properties

Three of the high-nickel alloys are non magnetic at sub-zero temperatures. (See Table).

Consideration of non-magnetic characteristics along with strength and ductility turns the spotlight immediately on "K" Monel. This alloy can be age-hardened and will remain non-magnetic to as low as −150° F. Severe cold work and age hardening do not change its non-magnetic characteristics.

A typical application is in the Sperry Horizon Instrument. Here the *combined* strength, ductility, corrosion-resistance and non-magnetic properties of "K" Monel single it out as the ideal material for long, accurate service.

* * *

For further information regarding the properties and working of INCO Nickel Alloys, write for a copy of the booklet "INCO Nickel Alloys for the Aircraft Industry." A copy is yours for the asking. Address:

Magnetic Properties

Material	Magnetic Transformation Temperature (Curie Point) °F at Permeability of 1.02 max	Permeability at Room Temperature H = 1 Oersted	Permeability at Room Temperature H = 200 Oersted
"K" Monel	minus 150	less than 1.02	1.005
"H" Monel	minus 70	less than 1.02	1.005
Inconel	minus 40	less than 1.02	1.005
Monel	110–140	25	15
Nickel	680	120	30
Iron	1410	5000	100

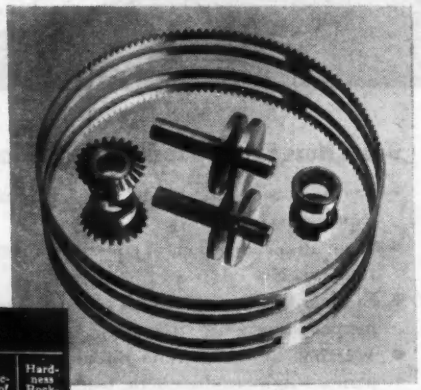
Summary of Effect of Low Temperatures on Nickel and High-Nickel Alloys

Increase with Decreasing Temperature	Remain Unchanged with Decreasing Temperature	Decrease with Decreasing Temperature
Tensile strength Yield strength Proof stress Proportional limit Tensile modulus Torsional modulus Brinell hardness Fatigue life (for a given load) Elongation	Reduction of area Impact strength	Length

Mechanical Properties at Low Temperatures*

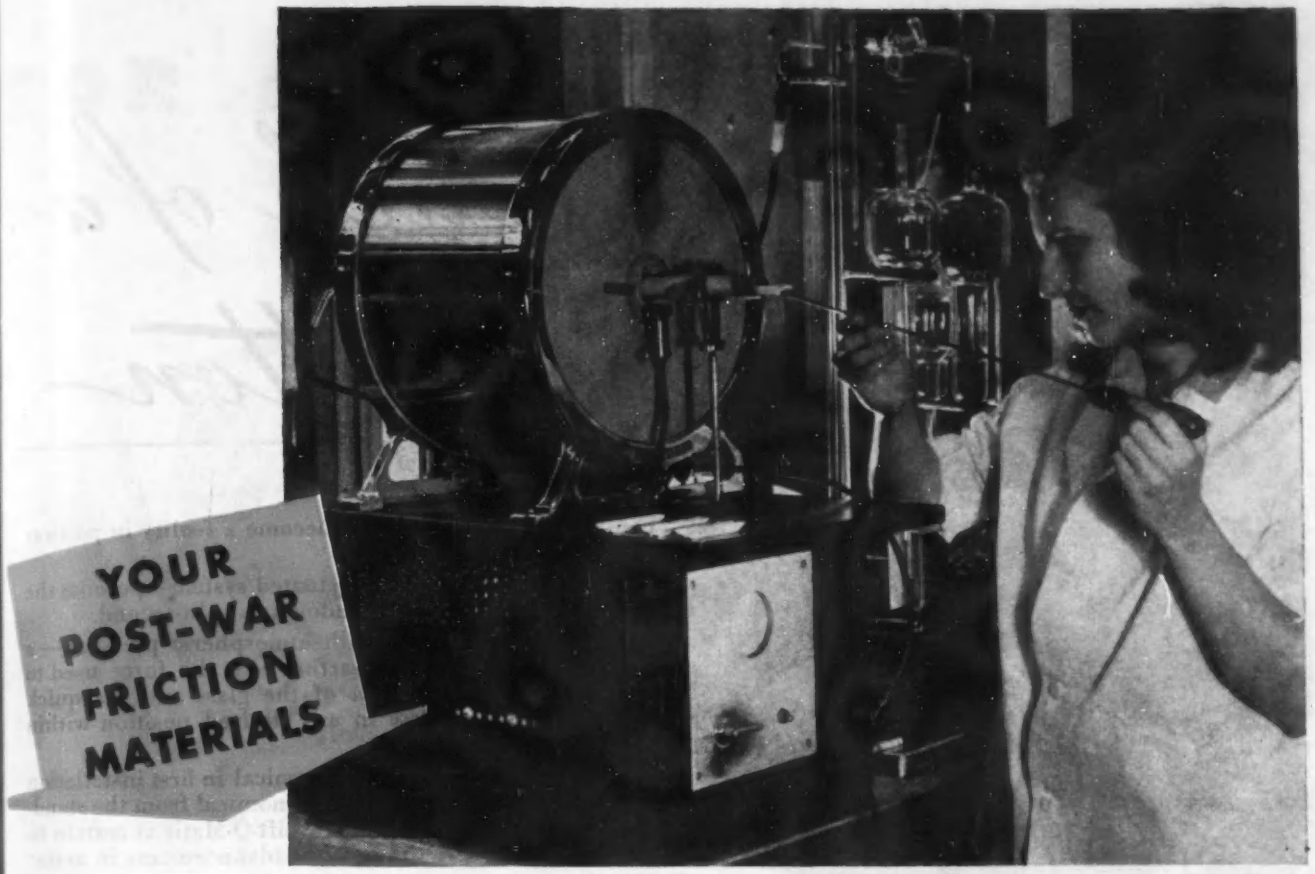
Material	Condition	Temperature °F	Yield Strength (0.20% offset) psi.	Tensile Strength psi.	Elongation in 2 in. per cent	Reduction of Area per cent	Hardness Rockwell C
Monel	Cold-drawn	Room	93,700	103,800	19.0	71.0	19
	Cold-drawn	−110	100,850	117,450	21.8	70.2	25
	Cold-drawn	Room†	93,300	103,400	17.3	72.5	21
Nickel	Cold-drawn	Room	97,400	103,400	16.3	66.9	19
	Cold-drawn	−110	101,800	112,300	21.5	60.9	22
	Cold-drawn	Room†	95,750	102,700	16.3	69.2	20
Inconel	Annealed	Room	36,800	93,800	37.3	64.1	82B
	Annealed	−110	42,400	106,150	39.8	64.0	87B
	Annealed	Room†	38,200	93,000	36.5	64.4	82B
	Cold-drawn‡	Room	147,700	152,100	7.0	49.3	31
	Cold-drawn‡	−110	154,900	163,900	9.8	51.2	36
	Cold-drawn‡	Room†	147,400	151,900	7.3	49.3	32
"K" Monel	Cold-drawn, age-hardened	Room	125,900	157,300	15.5	37.4	33
	Cold-drawn, age-hardened	−110	134,600	171,550	17.3	41.1	36
	Cold-drawn, age-hardened	Room†	125,850	157,350	14.8	37.2	33

*Bureau of Standards Report, June 14, 1937.
†Cooled to and held at −110° F for several hours prior to testing at room temperature
‡50 per cent reduction in cross-sectional area by cold drawing



PARTS FOR SPERRY HORIZON INSTRUMENT. Tough, strong, *non-magnetic* "K" Monel assures accuracy...longer life. These parts are machined soft, then heat-treated for maximum strength and hardness.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL ST., NEW YORK 5, N. Y.



...are being perfected NOW!

MEASURING the exact amount of carbon in each Velvetouch formula, as shown in the photograph above, is only one of many controls by which we assure uniformity of quality. Our laboratories are engaged in never-ending research to improve still further the friction qualities of Velvetouch *all-metal* clutch facings and brake linings . . . so that you may safely specify Velvetouch for rugged, heavy-duty operating conditions in all types of industrial machinery.

THE S. K. WELLMAN COMPANY

1374 EAST 51st STREET • • CLEVELAND 3, OHIO

Velvetouch is *all metal* —a combination of powdered metals, compressed, sintered and welded to a solid steel backing.

For Brake and Clutch . . . Use Velvetouch

The "INSIDE STORY" of POWDER METALLURGY

CHAPTER 1. Powdered metals—iron, lead, tin, etc.—first are carefully blended in the right proportions for each type of brake and clutch. After thorough mixing, they are ready for the molding and sintering operations.

WITH THE *Touch of a Button*

. . . control of car windows will become a reality in postwar model motor cars.

The Lift-O-Matic—a power-actuated system—permits the full opening or closing of a window in a split-second.

Vacuum, in combination with atmospheric pressure—a power so fully developed in wartime—is the force used to insure this speedy movement of the glass and the quick adjustment of the window in any desired position within the range of movement.

Economical in application, economical in first installation cost and, what is very important, economical from the standpoint of operation and service, the Lift-O-Matic is certain to be identified as one of the notable advancements in motor car operation.

From the standpoint of *safety*, power-actuated motor car windows contribute materially in avoidance of driving hazards, while providing comfort and added pleasure in car operation.

Concealed within the door hinge, a conduit conveys the vacuum power to the simple cylinder power unit thru which the lifting and lowering movement is transmitted to the window glass over roller-bearing sheaves, over which flexible aeroplane control cables perform as an endless belt. Any of these cables has lifting power sufficient to support the weight of a car engine. They are thoroughly dependable. In addition to test during the war years in their universal application in aeroplane control work of fighter and bombing planes, the adaptation to Trico's window controls is the result of extensive specific test.

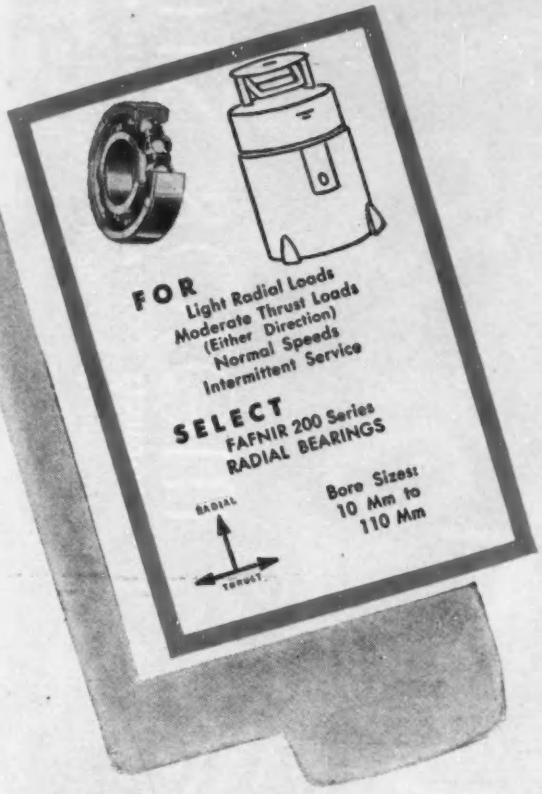
The Lift-O-Matic is a sturdy instrument which not only lifts and lowers but locks the window in any desired position to resist any prying movement downward, still permitting manual movement of the glass to a closed position even when the power is disconnected. The locking device functions in the Lift-O-Matic whether or not power is applied.

Made by TRICO . . . Manufacturers of automatic windshield wipers used as standard on millions of cars for 25 years.

BUY WAR BONDS NOW . . . AND PLAN FOR YOUR NEW CAR OF TOMORROW.

TRICO PRODUCTS CORPORATION, Buffalo 3, New York

FOR A POST WAR WORLD OF USES



A GOOD TIME TO CHANGE

ARE YOU one of those who is "going back to making our old lines again"?

The old lines may still be the best of their kind, but the *old way* of making them may not be the best. A good example is the equipment manufacturer who was looking for ways of cutting down on the number of operations needed to machine shoulders in his castings to hold the bearings. In search of a less costly way, a Fafnir engineer was called in. On his advice an entirely different type of ball bearing was substituted which resulted in the elimination of several operations with no sacrifice in performance.

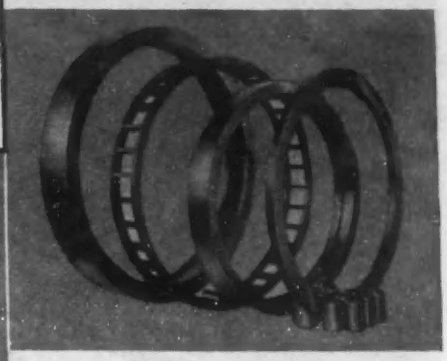
Why not call in a Fafnir field engineer to advise you on your old products or new ones you are planning? He may be able to help you to cut costs, improve performance. He has done it for many others. The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR
BALL BEARINGS

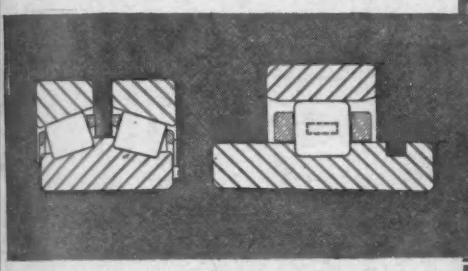
BUY MORE WAR BONDS AND STAMPS

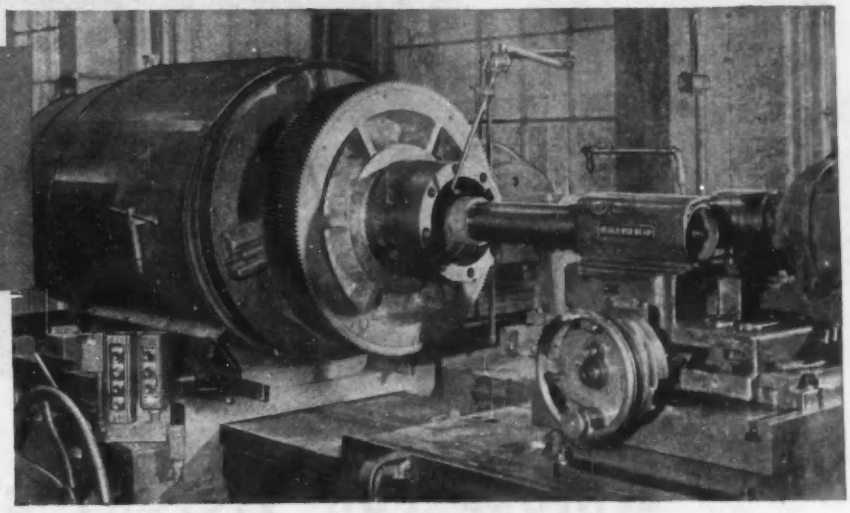
MOTOR STATE
PRODUCTS COMPANY, YPSILANTI, MICHIGAN
Originators of the hydraulic push-button top

IN THE NEWS
WITH TORRINGTON BEARINGS

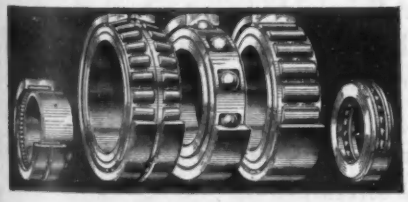


MEETING DESIGN REQUIREMENTS of the Emsco Derrick & Equipment Company, the engineers of Torrington's Bantam Bearings Division custom-built the 27½" O.D. Radial Roller Bearings employed in the sheaves of the crown and traveling blocks. The bearings, mounted on a center drum, are located close to the rope grooves to conserve wire line, prevent hazardous tilting, and to minimize wear on the sheaves.



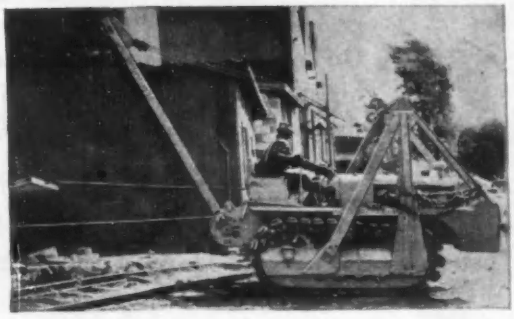


GRINDING HEAVY PARTS TO PRECISION LIMITS, this mammoth grinder, built by the Ingersoll Milling Machine Company, utilizes a Torrington Tapered Roller Bearing to carry the heavy radial and thrust loads encountered in the operation of the spindle. It is mounted directly behind the chucking mechanism which holds the work in position for grinding. A tapered bore radial roller bearing is mounted on the back end of the spindle, where a "V" belt pulley connects direct to the motor drive. After four years in operation the eccentricity and face run-out of these bearings is .00025.



EVERY MAJOR TYPE OF ANTI-FRICTION BEARINGS is included in the Torrington line—straight roller, tapered roller, needle and ball. In addition to supplying every branch of industry with a wide range of standard bearings, the engineering staff of Torrington's Bantam Bearings Division designs bearings in large sizes and of special types for new or unusual applications. For experienced counsel in meeting today's requirements—or assistance in postwar plans TURN TO TORRINGTON.

DESIGNERS of this Williamette Hyster towing winch, installed on a Caterpillar tractor, specified heavy-duty Torrington Needle Bearings for use in the idler and reverse gears. The Williamette Hyster Company says, "Because of the restricted space in the comparatively small gears, needle bearings are the only practical type of anti-friction bearings that can be used."



ARMY E NAVY

TORRINGTON BEARINGS

STRAIGHT ROLLER • TAPERED ROLLER • NEEDLE • BALL

THE TORRINGTON COMPANY • BANTAM BEARINGS DIVISION

SOUTH BEND 21, INDIANA

WINGED FOR VICTORY *by Fairchild*

On wings built by Fairchild, the Navy's big patrol bombers—Martin PBM-3 Mariners—fly to war over the seven seas.

They've sent many a submarine to the bottom. They soar by the hundred over icy arctic waters; patrol the far reaches of the Pacific; carry bombs and munitions, cargo and men to combat on distant naval fronts.

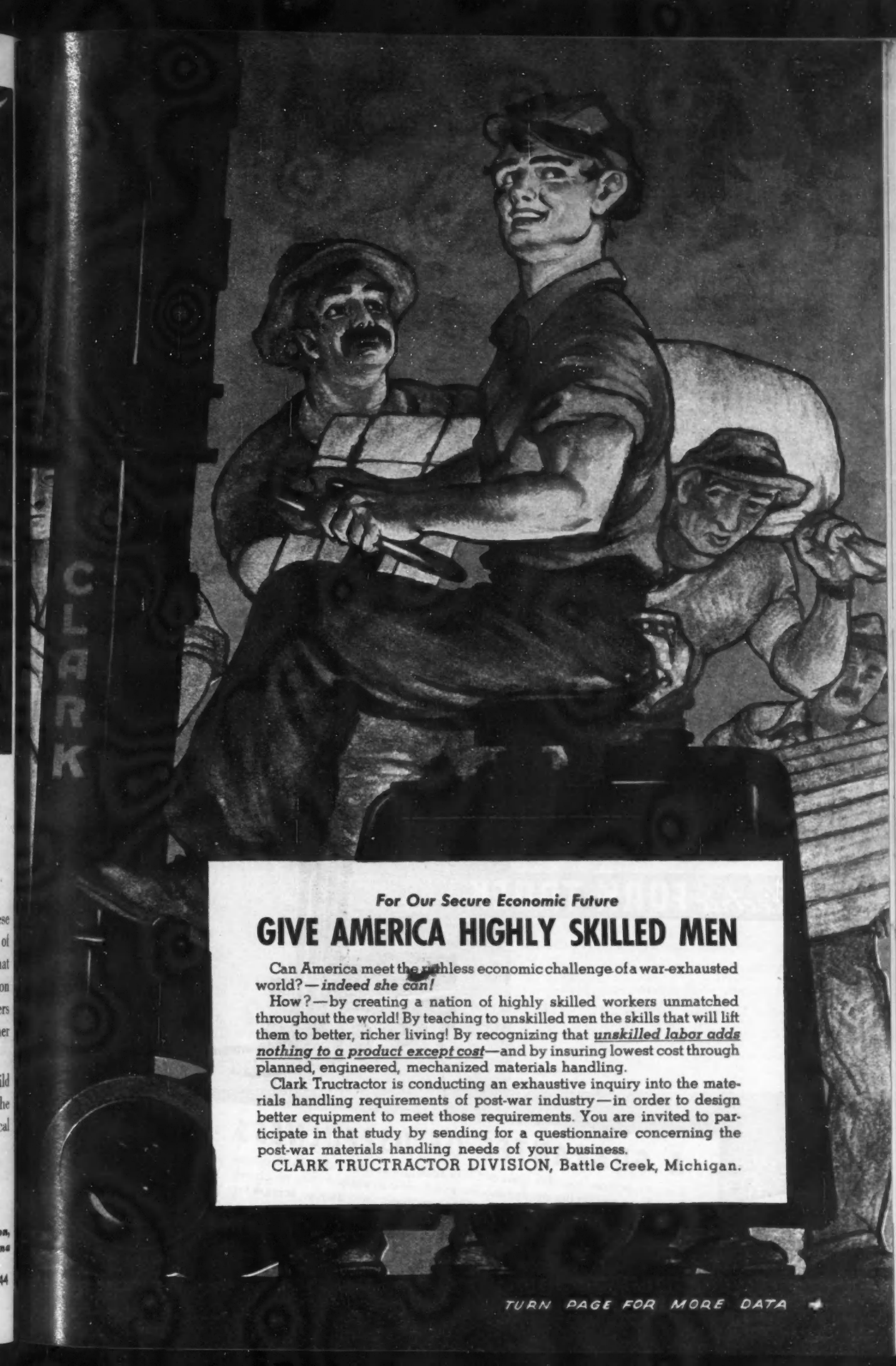
Behind their constantly increasing numbers is the story of industrial America at war—the story of American vision, enterprise, initiative and cooperation combining to accomplish the "impossible".

Three years ago there was a critical need for these big flying boats. Fairchild undertook the job of building the vital wing panels despite the fact that Fairchild had just launched a heavy production schedule, building famous Cornell primary trainers for the Army Air Forces, and manufacturing other Fairchild-designed aircraft.

In this day of industrial miracles, this Fairchild accomplishment stands as another example of the job that can be done with cooperation, technical knowledge and production skill.

BUY U. S. WAR BONDS AND STAMPS

Fairchild Aircraft *Division of Fairchild Engine & Airplane Corporation, Hagerstown, Maryland....Burlington, North Carolina*



For Our Secure Economic Future

GIVE AMERICA HIGHLY SKILLED MEN

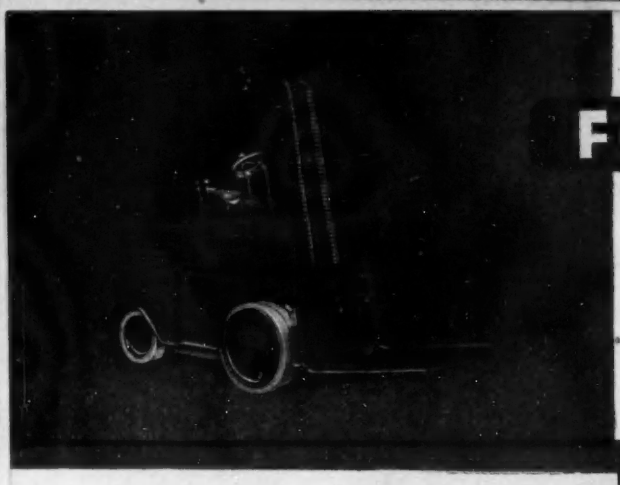
Can America meet the ruthless economic challenge of a war-exhausted world?—*indeed she can!*

How?—by creating a nation of highly skilled workers unmatched throughout the world! By teaching to unskilled men the skills that will lift them to better, richer living! By recognizing that ***unskilled labor adds nothing to a product except cost***—and by insuring lowest cost through planned, engineered, mechanized materials handling.

Clark Tructractor is conducting an exhaustive inquiry into the materials handling requirements of post-war industry—in order to design better equipment to meet those requirements. You are invited to participate in that study by sending for a questionnaire concerning the post-war materials handling needs of your business.

CLARK TRUCTRACTOR DIVISION, Battle Creek, Michigan.

TURN PAGE FOR MORE DATA

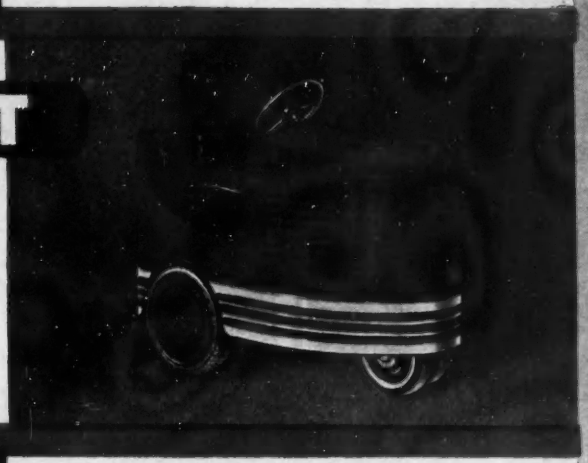


FORK TRUCK

Fast, sturdy, easy to maneuver in close quarters, Clark Fork Trucks are on the job 24 hours of every day—lifting, moving, tiering, stacking loads of 1000 to 7000 pounds.

CLARKAT

Through busy aisles, and from docks and warehouses, these husky Clarkats haul trailer trains carrying loads 20 times their own weight. Twin front wheels assure stability. Gas powered.

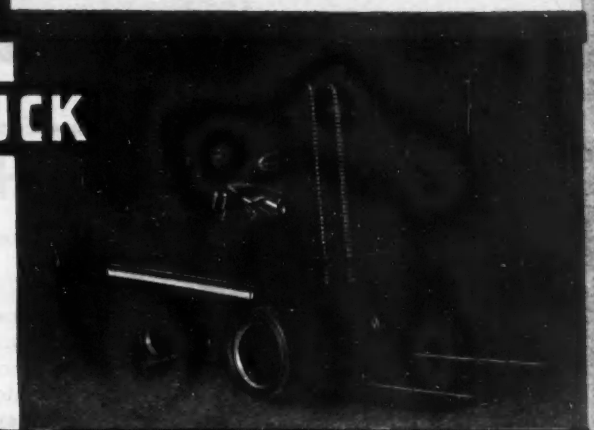


CLARKTOR-6

At railway terminals and airports, across factory yards, the "Clarktor-6" is ideal equipment—hauling heavily loaded trailers. This all purpose heavy duty tractor with its six-cylinder engine, has a remarkable performance record.

Electric FORK TRUCK

Here is another consistent worker—Clark Fork Truck **electric powered.** Compact and rugged, with smooth, even power, it handles loads from 1000 to 7000 pounds, saving vital man-hours and money. A better unit at a lower price.



A GUARANTEE OF USEFULNESS

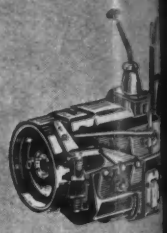
For nearly three decades users of Clark Fork Trucks and Industrial Tractors have been getting the sturdy usefulness and low-cost performance which the name Clark instantly guarantees. Clark engineers are at your service for study of your materials handling problems.

CLARK TRUCTRACTOR

Division of CLARK EQUIPMENT COMPANY • BATTLE CREEK, MICHIGAN
Also BUCHANAN . . . JACKSON . . . BERRIEN SPRINGS, MICH.

Another PRODUCT of CLARK EQUIPMENT COMPANY

Some CLAR product



TRANSMISSIO

BLIND RIVETING

AXLE HOUSIN

FRONT AND REAR FOR TRUCKS AND

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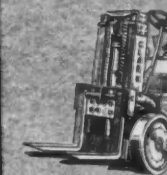
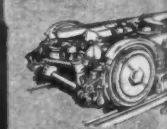
ELECTRIC STEEL CA



INDUSTRIAL TRU AND TRACTO



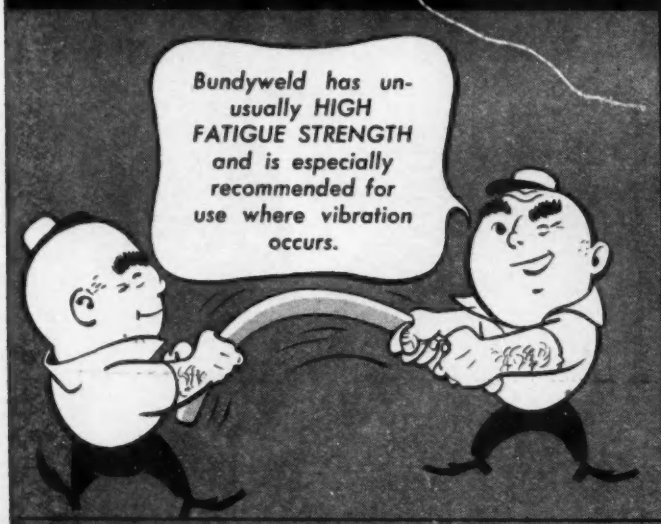
RAILWAY CAR TR

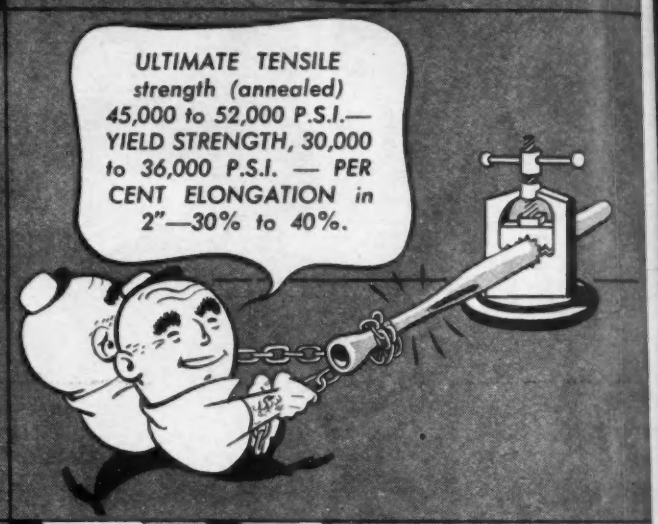
METAL SPOKE W

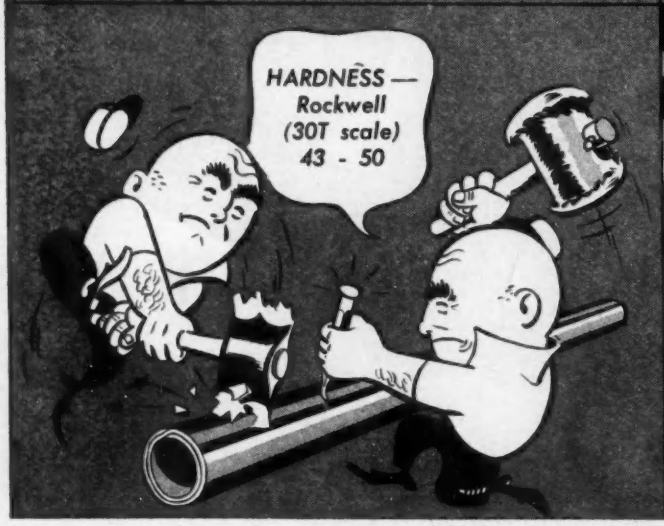
Bearing GOOD WILL

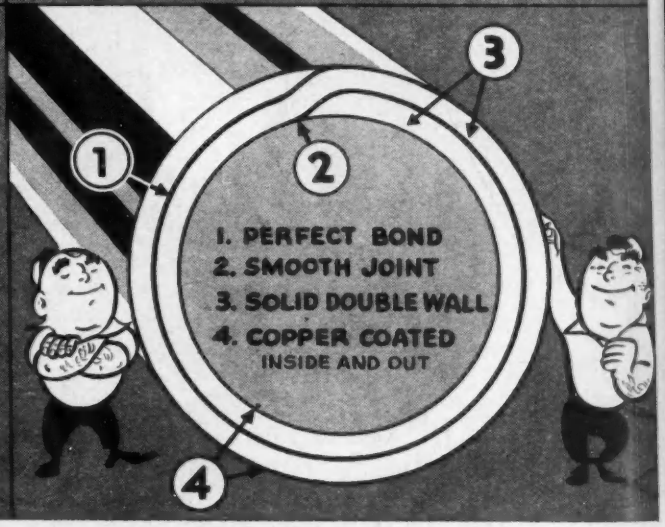
BOWER ROLLER BEARING CO.

BUNDYWELD can take it




ULTIMATE TENSILE strength (annealed) 45,000 to 52,000 P.S.I.— YIELD STRENGTH, 30,000 to 36,000 P.S.I. — PER CENT ELONGATION in 2"—30% to 40%.





BUNDY TUBING

ENGINEERED TO YOUR EXPECTATIONS

BUNDY TUBING DISTRIBUTORS AND REPRESENTATIVES:

Pacific Metals Company, Ltd.
3100 19th Street
San Francisco 10, California

Standard Tube Sales Corp.
1 Admiral Avenue
Maspeth, New York City, N. Y.

Lapham-Hickey Company
3333 W. 47th Place
Chicago 32, Illinois

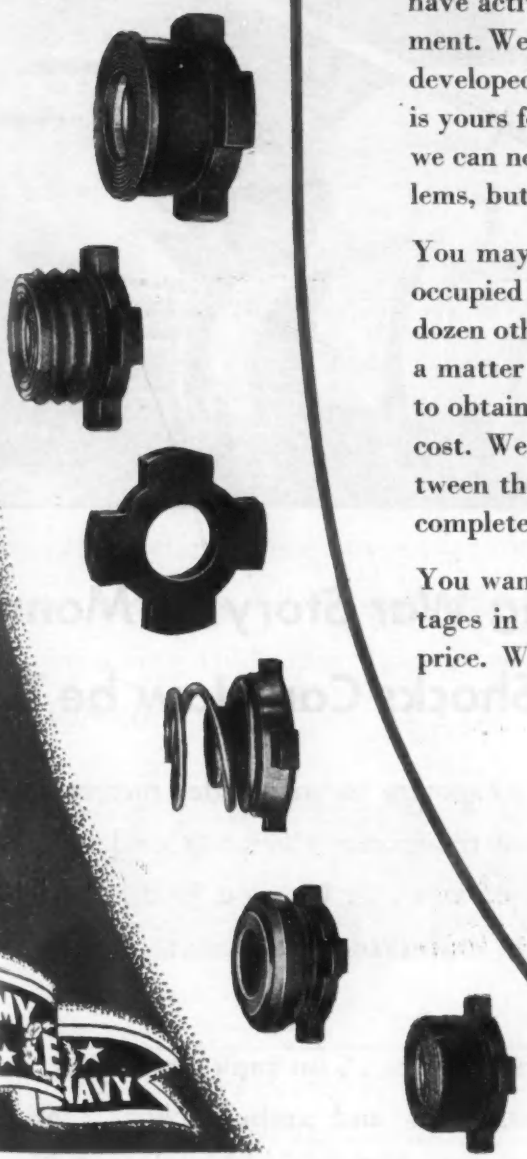
Rutan & Company
112 South 16th Street
Philadelphia 2, Pennsylvania

Eagle Metals Company
3628 East Marginal Way
Seattle 4, Washington

A complete WATER PUMP *service*
FOR YOUR NEW PRODUCT....
FOR IMPROVING PRESENT MODELS

THE MARK OF MERIT
AQUA-TITE

Automatic
SHAFT SEALS
for All Requirements
AUTOMOTIVE
and **STATIONARY**



ARMY ★★★ NAVY

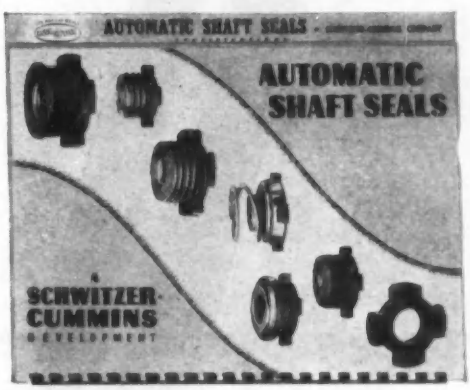
Manufactured by

Schwitzer-Cummins will produce a FINE SEAL—a FINE IMPELLER —or a COMPLETE PUMP for you and all at a decided advantage in the performance of your product.

We have been specialists in the design and building of water pumps since the pioneering days of the automotive industry, and have actively participated in every era of the industry's development. We are the originators of the Automatic Shaft Seal and have developed it to its present stage of perfection. This long experience is yours for the asking. We invite your inquiries in the belief that we can not only be of assistance to you in your engineering problems, but can save you money as well.

You may want more water. You may have to reduce the space occupied by the pump. You may have a persistent leakage, or a dozen other troubles. Let us tackle the job. We will not take it as a matter of simply selling you merchandise, but as an obligation to obtain for you a highly efficient performance at a minimum of cost. We know so well the close relationship there must be between the seal, the impeller, and the pump itself if there is to be complete satisfaction.

You want either advantages in performance or price. We have both.

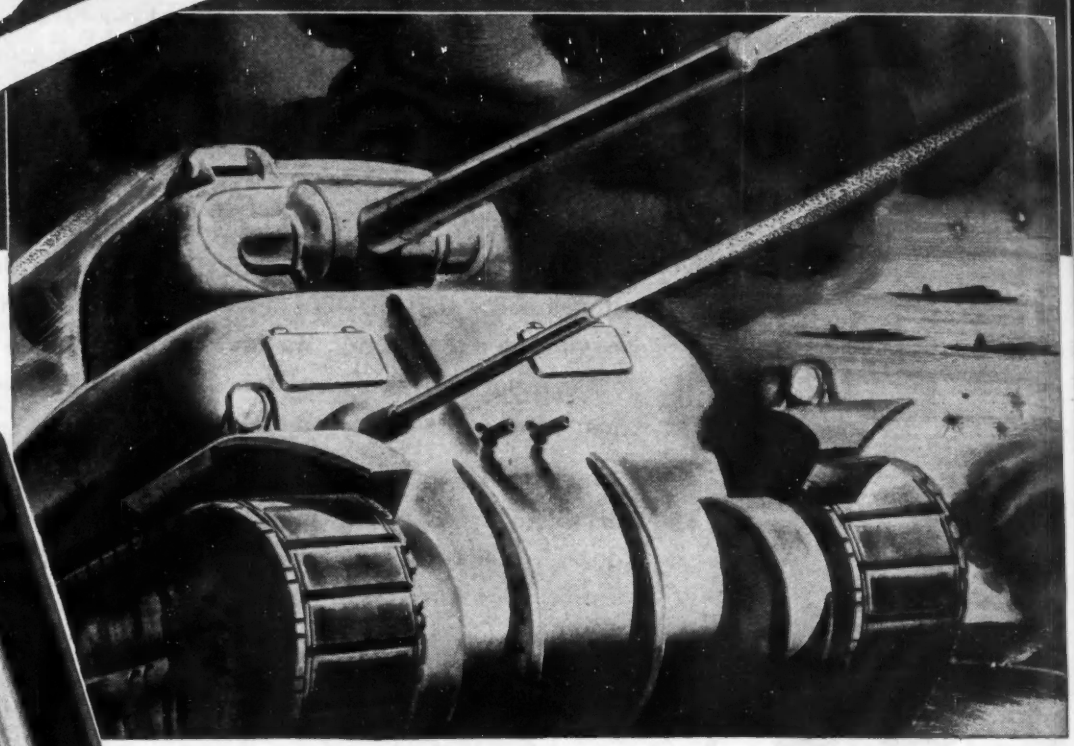


Send Today FOR OUR NEW CATALOG...
THE STORY OF AUTOMATIC SHAFT SEALS
A SCHWITZER-CUMMINS DEVELOPMENT

THE MARK OF MERIT
AQUA-TITE

SCHWITZER-CUMMINS COMPANY
INDIANAPOLIS, INDIANA, U. S. A.

TODAY LOOK



The Thrilling War Story of Monroe Hydraulic Shocks Can Now be Told

Because of their capacity to soften destructive shocks, jolts, jars . . . and to operate efficiently under the merciless pounding of war . . . Monroe Hydraulic Shocks were selected as standard equipment on American made tanks.

In all theatres of war . . . on tank destroyers, troop transports, Jeeps, buses and ambulances . . . Monroe Hydraulics have proved they can be depended upon to do a *better* job.

TO MONROE

FOR TOMORROW'S FINEST HYDRAULIC SHOCK ABSORBERS

Higher post-war speed for passenger and freight . . . by motor car, truck, bus or railway . . . will demand the perfection and dependability of Monroe Hydraulic Shock Absorbers . . . the only airplane type, *triple action* Shock Absorber.

Tested and proved in war and at home . . . Monroe Hydraulic Shock Absorbers feature Economy . . . Comfort . . . Safety and Long Life . . . far above and beyond pre-war standards. For the positive solution to problems involving Hydraulic Shock Absorbers . . . *LOOK TO MONROE.*

MONROE

MONROE AUTO EQUIPMENT CO. . . . MONROE, MICH.

DESIGNING ENGINEERS

America's foremost engineers are looking ahead and are incorporating Monroe's Hydraulic Shock Absorbers into their products. They assure top performance under all conditions. Available NOW in sizes to do the job. Our engineers will gladly cooperate with you. There is no obligation. Just write, wire or phone.

FREE

CLIP AND MAIL COUPON

MONROE AUTO EQUIPMENT CO.
Monroe, Michigan

Without obligation kindly send more information about Monroe's Hydraulic Triple Action Shocks for

☐ Automobiles ☐ Trucks ☐ Buses
☐ Fleets ☐ Railroads
☐ Service Station Replacement deal and prices.

Name & Title.....

Company.....

Address.....

City.....*State*.....

SIMPLICITY . . .

Another Important Advantage of VICKERS HYDRAULIC POWER STEERING

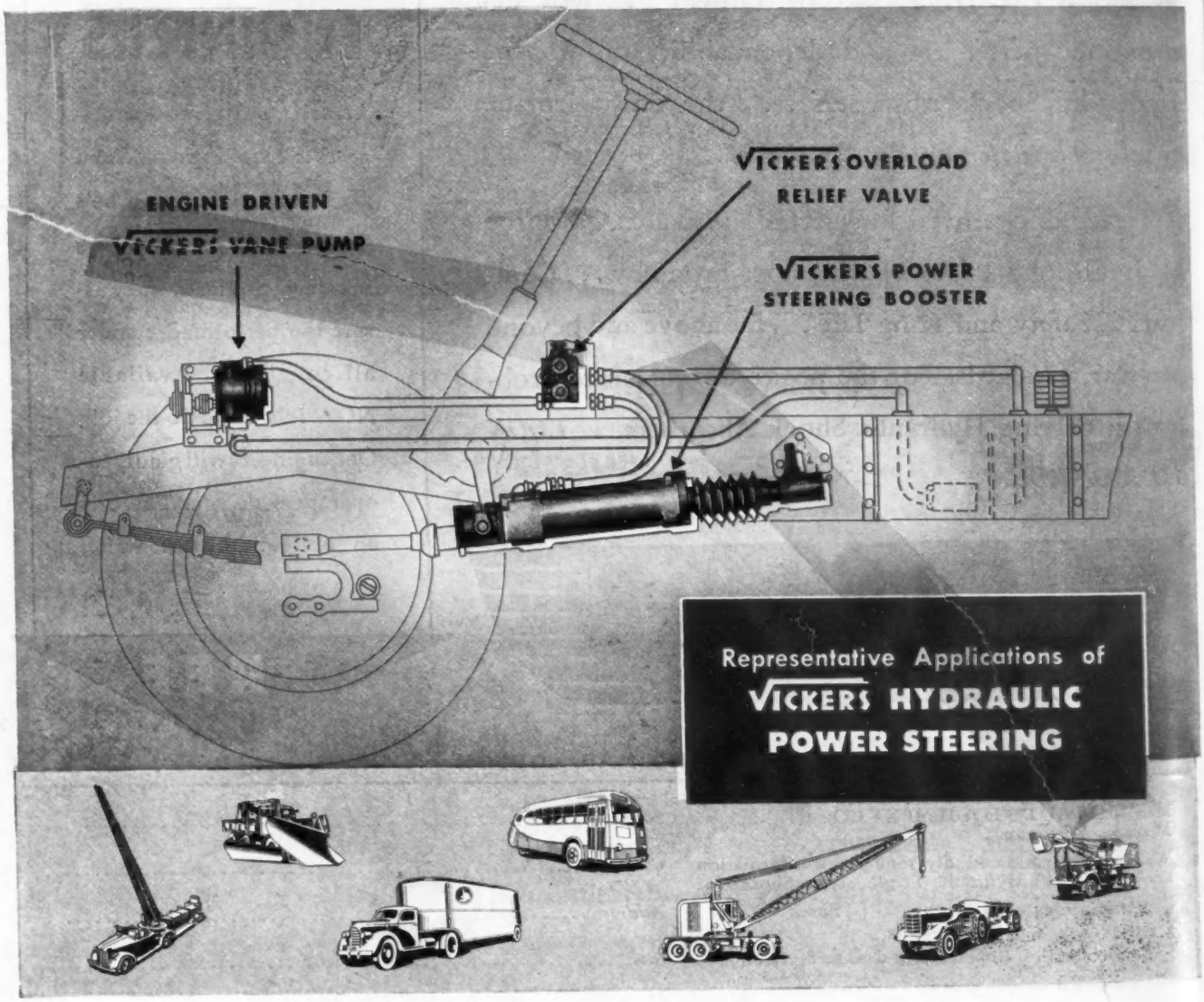
The simplicity of the Vickers Hydraulic Power Steering System is evident from the typical application shown below. The System consists primarily of an engine-driven hydraulic pump, a pressure overload safety valve and the booster unit.

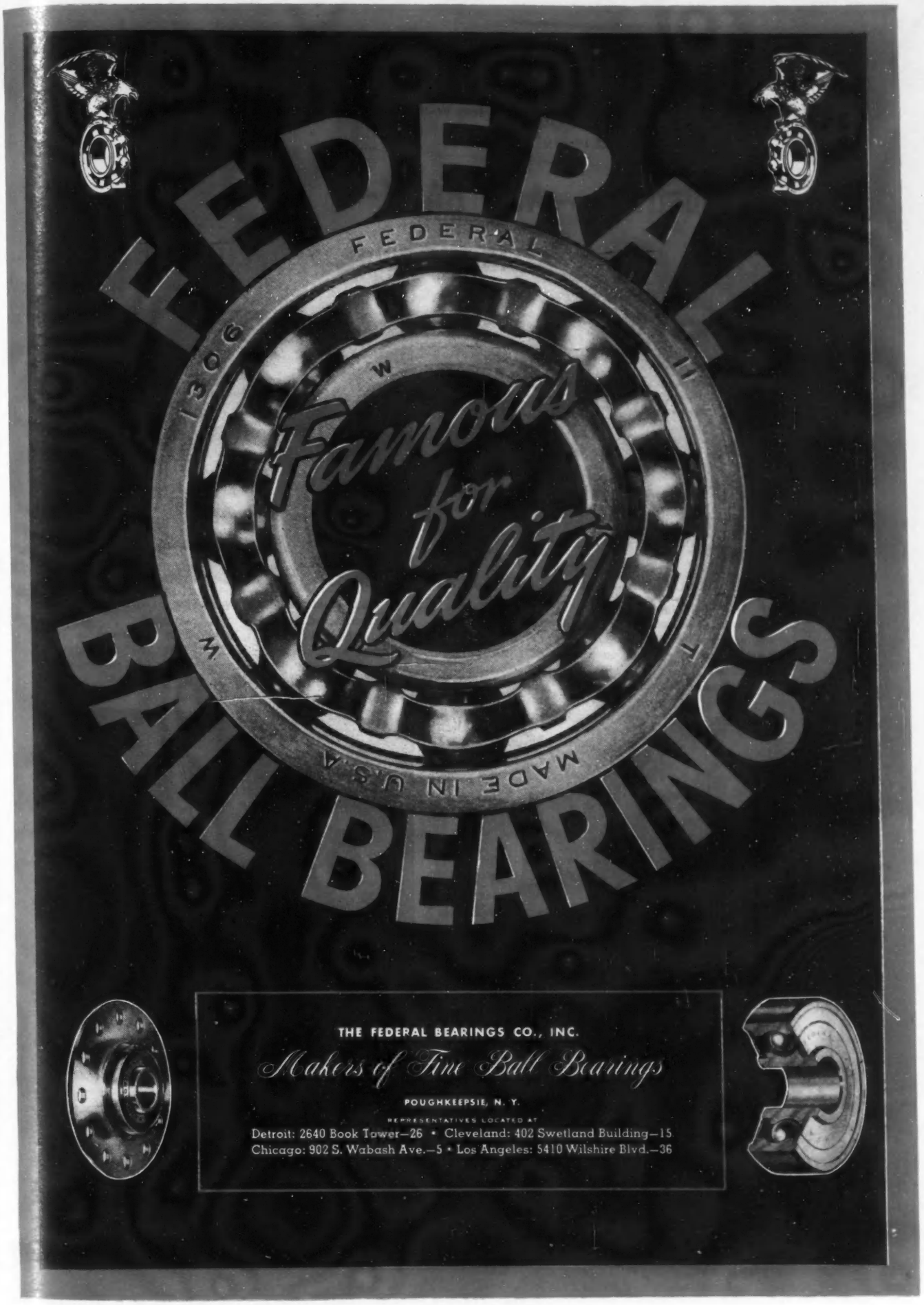
The booster is essentially a double acting hydraulic jack with integral control valve which instantaneously responds to the slightest steering wheel movement . . . directing oil under pressure to the booster cylinder and producing linear movement of the attached drag link. The steering effort is not transmitted through the steering gear.

Providing effortless, positive and shockless steering of even the heaviest vehicles, the Vickers Hydraulic Power Steering System has been in use under the most adverse operating conditions for the last 14 years. It assures greater driver efficiency by reducing fatigue to a minimum . . . it is easily applied to existing chassis designs . . . it provides automatic overload protection for both steering linkage and hydraulic system . . . it is automatically lubricated. Ask for new Bulletin 44-30 describing all the advantages of Vickers Hydraulic Power Steering.

VICKERS *Incorporated* • 1440 OAKMAN BLVD. • DETROIT 32, MICHIGAN

Application Engineering Offices: CHICAGO • CLEVELAND • DETROIT • LOS ANGELES • NEWARK • PHILADELPHIA ROCHESTER • ROCKFORD • TULSA • WORCESTER




FEDERAL
BALL BEARINGS
FEDERAL
Famous for Quality
MADE IN U.S.A.
THE FEDERAL BEARINGS CO., INC.
Makers of Fine Ball Bearings
POUGHKEEPSIE, N. Y.
REPRESENTATIVES LOCATED AT
Detroit: 2640 Book Tower—26 • Cleveland: 402 Swetland Building—15
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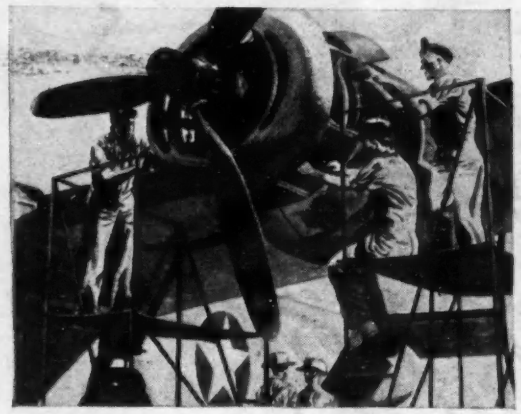
This advertisement is one of a series which is appearing in national magazines and newspapers as Consolidated Vultee's contribution toward a clearer public understanding of transportation's role in the war, and its postwar opportunities and responsibilities.

To Australia—AND BACK—

in 95 hours and 20 minutes!



1. 12:00 midnight Sunday: A huge Liberator Express, loaded with a secret cargo, roars down its California runway and soon dwindles to a speck on the horizon. The dispatcher checks off another routine flight for CONSAIRWAY, the military airline established in 1942 by Consolidated for the Air Transport Command.

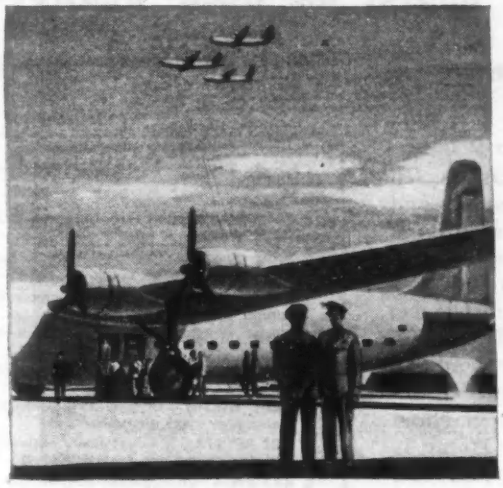
2. 10:30 p. m. Tuesday: The ground crew at an Australian airport speedily unloads the Liberator's high-priority cargo . . . checks the engines . . . heaves aboard tons of mail for the U. S. A. A new "Pony Express" flight crew jogs out, climbs aboard, and the giant transport streaks down the runway for the return trip.

4. So far, CONSAIRWAY Liberators have made 1764 round trips between the U. S. and Australia—a total of 25,900,000 over-water miles, without a single fatal accident. The original Liberator that pioneered the Australia run has now completed 84 round trips and is still going strong!

5. Born of war, CONSAIRWAY's job, in the beginning, was to bring back Ferry pilots who had delivered bombers to the South Pacific. Westbound cargoes, today as then, consist of tons of spare aircraft engines and parts, medical supplies, and ammunition—in short, *any* supplies that are *needed fast* by our fighting men "Down Under."

CONSOLIDATED VULTEE AIRCRAFT

3. 11:20 p.m. Thursday: The Liberator contacts the control tower at its California airport . . . "CONSAIRWAY plane No. 10 coming in!" . . . and it's back home again. Since it left that same airport, 95 hours and 20 minutes ago, the land-based Liberator Express has logged 14,690 miles over the Pacific—to Australia and back!



6. After the war, long-range Liberator planes will continue to supplement other forms of transportation—the train, truck, and ship—in rebuilding the peacetime world. But airplanes will also have *another* role to fulfill: a permanent postwar Air Force can become America's soundest investment in the interests of a lasting peace.

No spot on earth is more than 60 hours' flying time from your local airport

From "Flying Jeeps" to Leviathans of the air — *The planes shown below were all designed and developed by Consolidated Vultee. When peace comes, the company will be in a position to provide the postwar equivalent of such planes, from small, privately owned "air flivvers" to huge, transoceanic cargo-and-passenger planes.*

LIBERATOR . . . 4-engine bomber

LIBERATOR EXPRESS . . . transport

CORONADO . . . patrol bomber

CATALINA . . . patrol bomber

VENGEANCE . . . dive bomber

VALIANT . . . basic trainer

RELIANT . . . navigational trainer

SENTINEL . . . "Flying Jeep"

QUICK FACTS FOR AIR-MINDED READERS

Atlantic "Millpond" — So far, during the war, Allied aircraft have flown more than 15,000 Atlantic Ocean crossings.

• • •

Life Saver—Probably one of the smallest warplanes in use, the famous Consolidated Vultee "Flying Jeep" has added a new job to its many other uses. Modified as a flying ambulance (*capacity: 1 litter*) it is speeding wounded men to base hospitals from small jungle clearings and other inaccessible spots.

• • •

Postwar "sky roads"—20,000 air strips, placed 10 miles apart in a pattern of squares, would cover the country. Adequately marked, they would enable the postwar small-plane owner to travel cross-country without learning a complicated system of navigation. Cost per strip: $6000 (*about ¼ the cost of 1 mile of national highway*).

• • •

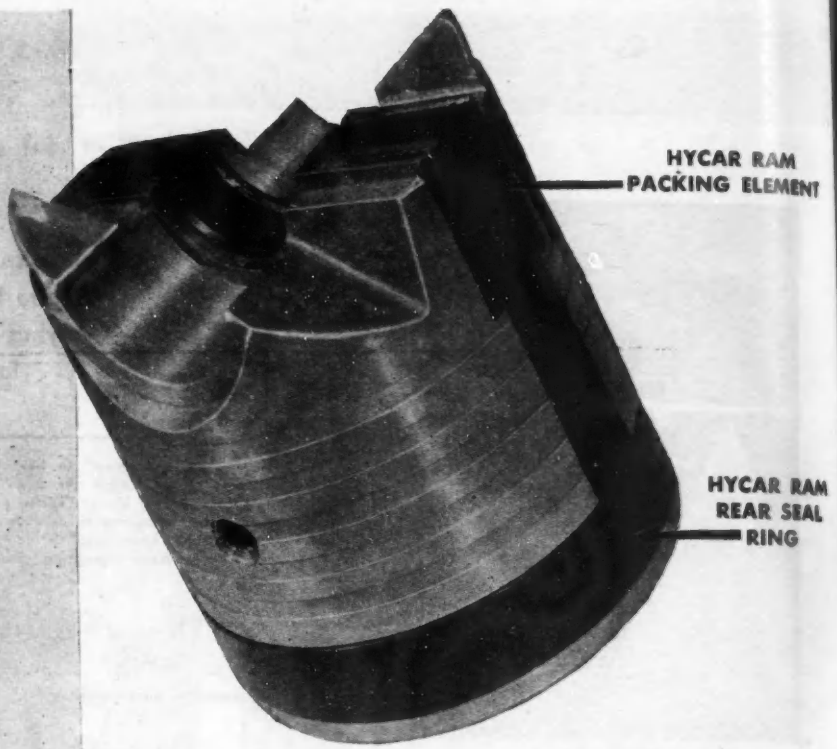
"It is becoming increasingly clear to an air-minded America that a greatly expanded Air Transport, a permanent postwar Air Force, and a healthy, competitive Aircraft Industry will be important factors in helping to maintain a lasting peace and prosperity." Tom M. Girdler, Chairman of the Board, Consolidated Vultee Aircraft Corporation.

Consolidated Vultee is the largest builder of airplanes in the world.

CORPORATION

San Diego, Calif. · Vultee Field, Calif. · Fairfield, Calif. · Tucson, Ariz. · Fort Worth, Texas · New Orleans, La. · Nashville, Tenn. · Louisville, Ky. · Wayne, Mich. · Dearborn, Mich. · Allentown, Pa. · Elizabeth City, N. C. · Miami, Fla.

Member, Aircraft War Production Council



HYCAR RESILIENT PACKINGS PREVENT COSTLY OIL WELL "BLOWOUTS"

Properties which make this possible have many applications in all industry

WHEN an oil well like the one in the picture "blows out", chances are that expensive tools and machinery will be ruined, oil will be wasted, the well will be useless, lives may be lost. That's why, a few years ago, a "blow-out preventer" was developed. It fits around the drill pipe at the top of the well, ready to go into action if the drill hits a high pressure zone deep down in the ground. When that happens the preventer closes around the pipe and makes a tight seal against pressures as high as 5000 p.s.i. The seal then has to be maintained—even when the pipe is being rotated while adjustments are being made—for 6 to 9 hours.

Hycar synthetic rubber was selected for the resilient sealing element—and for good reasons. Hycar is able to provide the *right combination* of properties needed for this job—oil and gas resistance, abrasion resistance, ability to stay resilient. These and other properties of Hycar synthetic rubbers are listed in the box at the right. They tell why men throughout industry are learning that Hycar is the right material for pump and valve packings, grommets, diaphragms, vibration dampeners, hose and scores of other industrial applications. *Hycar Chemical Co., Akron 8, Ohio.*

Check These Superior Features of Hycar

1. **EXTREME OIL RESISTANCE**—insuring dimensional stability of parts.
2. **HIGH TEMPERATURE RESISTANCE**—up to 250° F. dry heat; up to 300° F. hot oil.
3. **ABRASION RESISTANCE**—50% greater than natural rubber.
4. **MINIMUM COLD FLOW**—even at elevated temperatures.
5. **LOW TEMPERATURE FLEXIBILITY**—down to —65° F.
6. **LIGHT WEIGHT**—15% to 25% lighter than many other synthetic rubbers.
7. **AGE RESISTANCE**—extremely resistant to checking or cracking from oxidation.
8. **HARDNESS RANGE**—compounds can be varied from extremely soft to bone hard.
9. **NON-ADHERENT TO METAL**—compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)

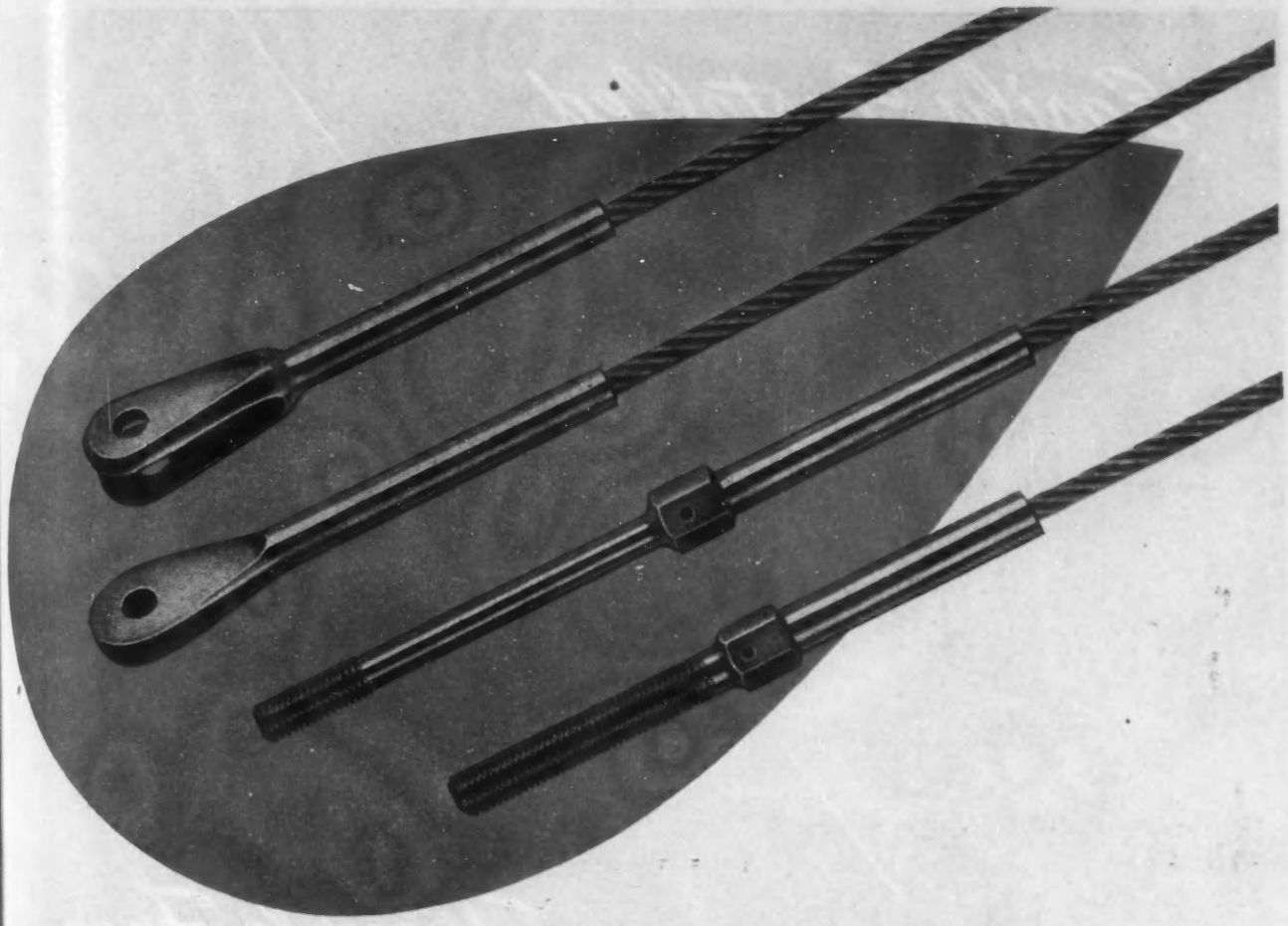
Hycar

Reg. U. S. Pat. Off.

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubber

Free—write for your copy of the new pocket-size Hycar Glossary of commonly used synthetic rubber terminology.



SPECIFY TRU·LOC TO MAKE SURE THAT YOU GET THE ORIGINAL SWAGED TERMINALS

As the aircraft industry developed, American Chain & Cable Company, Inc., instituted a continuous program designed to actually anticipate demands that would be created by advances in aircraft design.

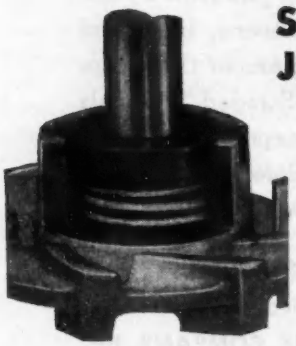
This program has already produced Center Pull Loop Fittings for secondary controls, Ball-Type Swaged Terminals and Ball with Strap Control Terminals—to mention but three of its concrete results.

It was—and is—a definite part of the program to develop the so-called "standard" sleeve-type swaged terminals so that in dimensions, swaging qualities, final strength and finish they would always be right on the beam. These swaged erminals were originated and patented by the American Chain & Cable Company, Inc.—and it might be worthwhile to remember that when you specify **TRU-LOC** you get Swaged Terminals that represent the greatest experience in the industry with them. For complete data and illustrated bulletin, address our Detroit office.

AUTOMOTIVE AND AIRCRAFT DIVISION
6-235 General Motors Building, Detroit 2
AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT, CONNECTICUT

ESSENTIAL PRODUCTS . . . TRU-LAY Aircraft, Automotive, and Industrial Controls, TRU-LOC Aircraft Terminals, AMERICAN CABLE Wire Rope, TRU-STOP Brakes, AMERICAN Chain, WEED Tire Chains, ACCO Malleable Castings, CAMPBELL Cutting Machines, FORD Hoists, Trolleys, HAZARD Wire Rope, Yacht Rigging, MANLEY Auto Service Equipment, OWEN Springs, PAGE Fence, Shaped Wire, Welding Wire, READING-PRATT & CADY Valves, READING Electric Steel Castings, WRIGHT Hoists, Cranes, Presses . . . *In Business for Your Safety*

The JOHN CRANE Bellows PUMP SEAL

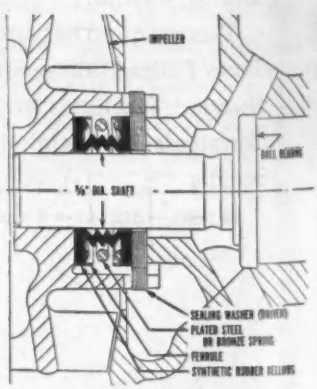


Seal and Washer in Operating Position (Under Load)

STANDARD EQUIPMENT . . . ON JEEPS, TANKS, TRUCKS, AIRCRAFT

- *Flexible*—Spring and bellows are self-adjusting.
- *Simple*—Consists only of the factory assembled bellows and spring, and a sealing washer.
- *Easily installed*—Assembly fits shaft loosely; slides easily into place, either end first (the two ends are identical).
- *Dependable*—Service records show perfect operation at 100,000 miles and more.

Ask for illustrated Bellows Pump Seal Bulletin



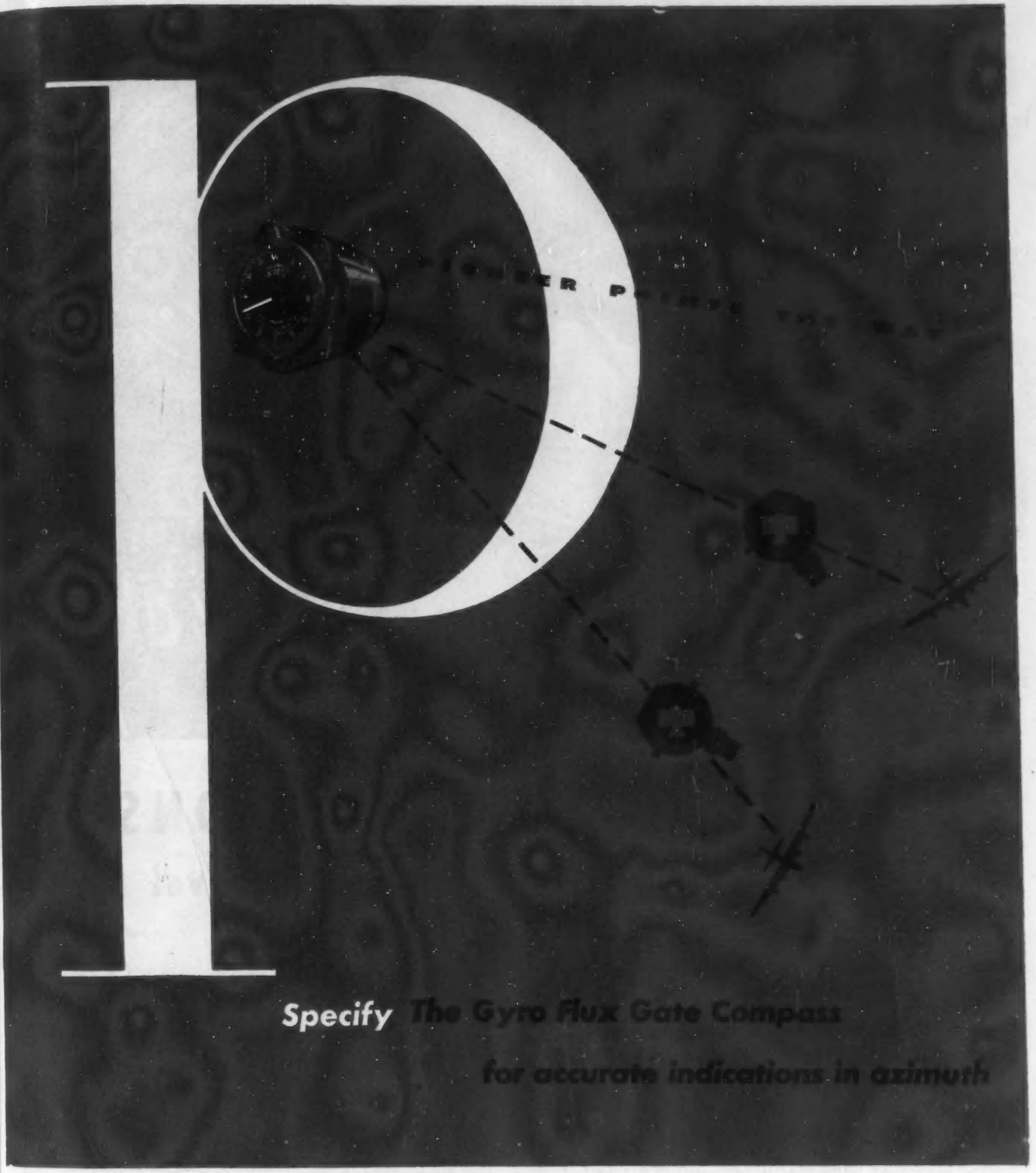
Typical Installation

CRANE PACKING COMPANY

1817 CUYLER AVE. • CHICAGO 13, ILL.

BALTIMORE, BOSTON, BUFFALO, CLEVELAND, DALLAS, DETROIT, HOUSTON, LOS ANGELES, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH, SAN FRANCISCO, ST. LOUIS, TULSA

CRANE PACKING CO., LTD., Hamilton, Ontario, Canada
Branches: Montreal, Toronto, Vancouver



Specifications for long-range aircraft call for the installation of the Pioneer Gyro Flux Gate Compass System because its master direction-indicator readings are steady and accurate in steep dives, fast turns, rough weather, or near the earth's poles. The Gyro Flux Gate Compass is a product of a great Creative Engineering team—a contribution of Pioneer's combined skills in mechanics, electro-mechanics, electro-magnetics, and electronics, . . . Month by month, as flying becomes safer, Pioneer points the way.

PIONEER INSTRUMENTS
Bendix, Pioneer, Gyro Flux Gate are trademarks of Bendix Aviation Corporation

ECLIPSE-PIONEER DIVISION
Teterboro, N. J.

Bendix
AVIATION CORPORATION

CECO ENGINEERING AT WORK IN WAR AND PEACE

PENNIES PROTECT MILLIONS

Protek-Plugs • • the Modern Moisture Removal Method

It began with aircraft engines. Once, it took many hours to remove the grease that was necessary to protect the cylinders of engines in transit.

Today, Protek-Plugs are removed from the spark plug openings, the spark plugs are installed, and in minutes, the engine is ready for service.

Protek-Plugs are hollow, transparent plastic containers, filled with Silica-gel, a material practically chemically inert, with a tremendous capacity for water. They remove corrosion-producing moisture from the cylinder walls by adsorption. When the Silica-gel approaches saturation, the plugs signal "Danger" as their color changes gradually from bright blue through violet to pink. The spent plug is then replaced with a fresh Protek-Plug.

Protek-Plugs are at work today by tens of thousands, not only in aircraft engines, but in delicate mechanisms of all kinds. There is ample proof of their value from every battle front. Costing pennies, they guard vital war equipment worth millions.

Tomorrow, this war-born product will protect more than the engines of aircraft in transit and in storage. It will find dozens of other jobs guarding the commerce of peace from moisture damage. Write for our illustrated booklet on Protek-Plugs.

CECO

CARBURETORS
FUEL PUMPS
PROTEK-PLUGS

CHANDLER-EVANS CORPORATION SOUTH MERIDEN, CONNECTICUT, U. S. A.

NEW TYPE "K" OIL SEAL

with 10 engineering advancements in Seal-ology

VICTOR GASKETS AND OIL SEALS — SEALING PRODUCTS THROUGH RESEARCH

VICTOR presents the Type "K" Oil Seal—newest member of the Victor family of precision oil seals, for present day and post-war application.

1 CONCENTRICITY CONTROLLED
With physical standards in terms of F.I.R. (Full indicator reading).

2 PROFILE CONTROLLED
With physical standards in terms of area of sealing element in contact with shaft.

3 LIP PRESSURE CONTROLLED
With physical standards in terms of ounces per lineal inch.

4 LOW FRICTIONAL DRAG
With physical standards in terms of ounce inches of torque.

5 HAMMERHEAD SEALING ELEMENT
Molded of specially compounded synthetic rubber for maximum seal life and minimum friction.

6 IMPROVED VICTOPRENE RUBBERS
For increased peripheral speeds, temperature range minus 50°F. to 275°F., increased stability in presence of lubricants and extraneous matter.

7 CLAMPED SEALING ELEMENT
Chemically bonded to a preformed and perforated steel washer.

8 GROUND O. D. DIMENSION
Controlled by precision centerless grinding.

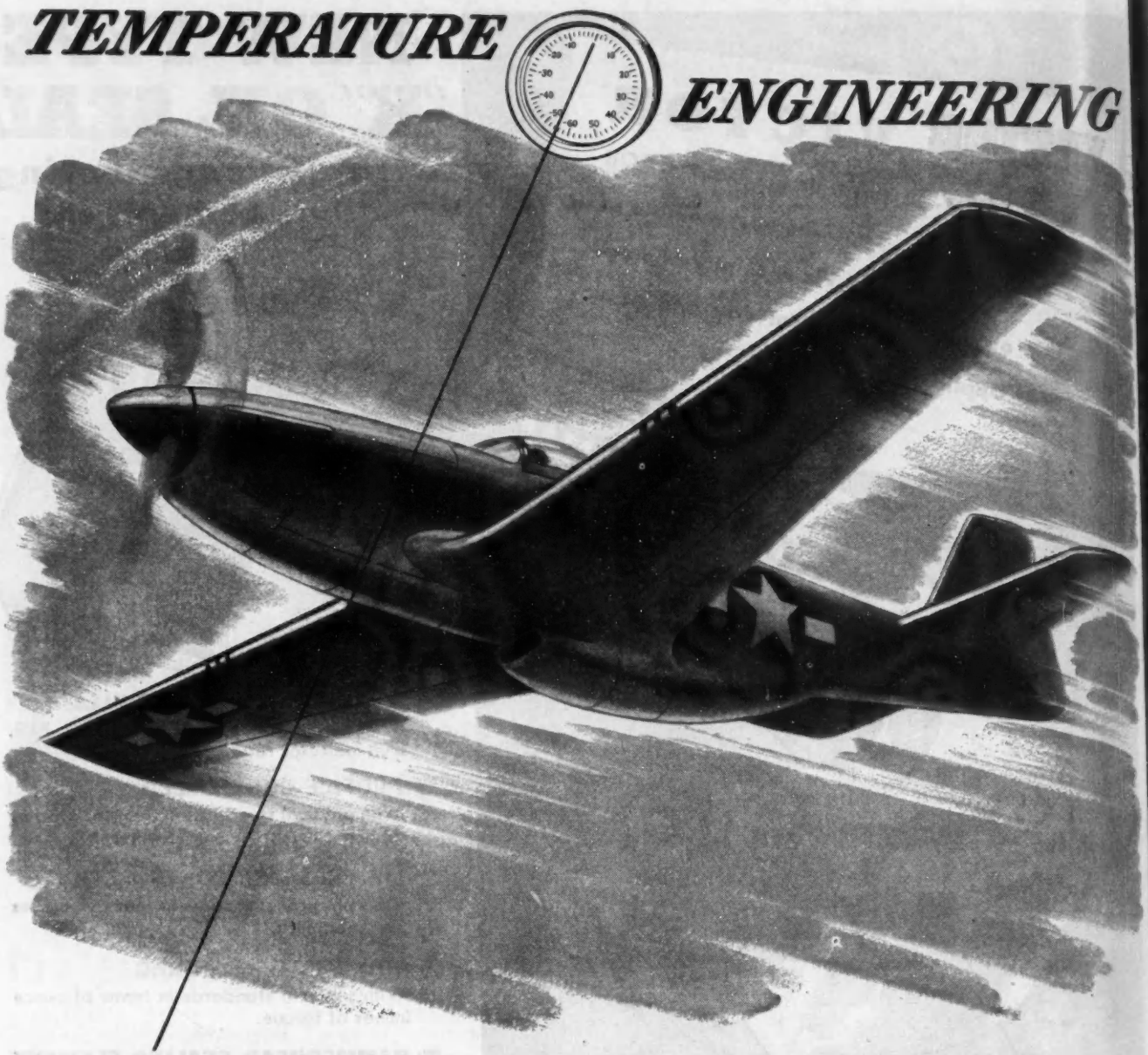
9 LIGHT WEIGHT GARTER SPRINGS
For reduced pressure on Hammerhead of sealing element.

10 PERMANENT IDENTIFICATION
Each seal steel stamped "VICTOR" and with catalogue number. Special seals stamped with product code.

VICTOR

MANUFACTURERS OF GASKETS

TEMPERATURE ENGINEERING



SAFEGUARDS AIRCRAFT ENGINE PERFORMANCE

Harrison radiators, oil coolers, supercharger intercoolers and other aircraft products are built with one purpose in mind: to remove heat wherever it is harmful, by the *lightest, most compact* unit that can be designed.

This is temperature engineering. It has been developed to a high degree of accuracy in Harrison's Aviation Testing Laboratories, where Harrison products are tested under varied conditions of flight, from Arctic cold to tropical heat. Harrison's constant research in thermodynamics, hydraulics and metallurgy is reflected in the design and construction of Harrison units serving today in military aircraft.

WAR BONDS SAVE LIVES

HARRISON

OIL COOLERS • CONTROL VALVES • RADIATORS
DIVERTER VALVES • SUPERCHARGER INTERCOOLERS

HARRISON RADIATOR DIVISION OF GENERAL MOTORS, LOCKPORT, NEW YORK

PREVIEW FOR YOUR CAST PRODUCTS

It's not by chance that C. W. C. castings meet every requirement for flexibility in design and excellence in quality!

A special metallurgical engineering service plus one of the most modern and completely equipped research laboratories enables C. W. C. to assure casting success *in advance*. Casting may be your most practical and most economical method of fabrication. Let C. W. C. engineers study your product and make recommendations. Write today . . . there is no obligation.

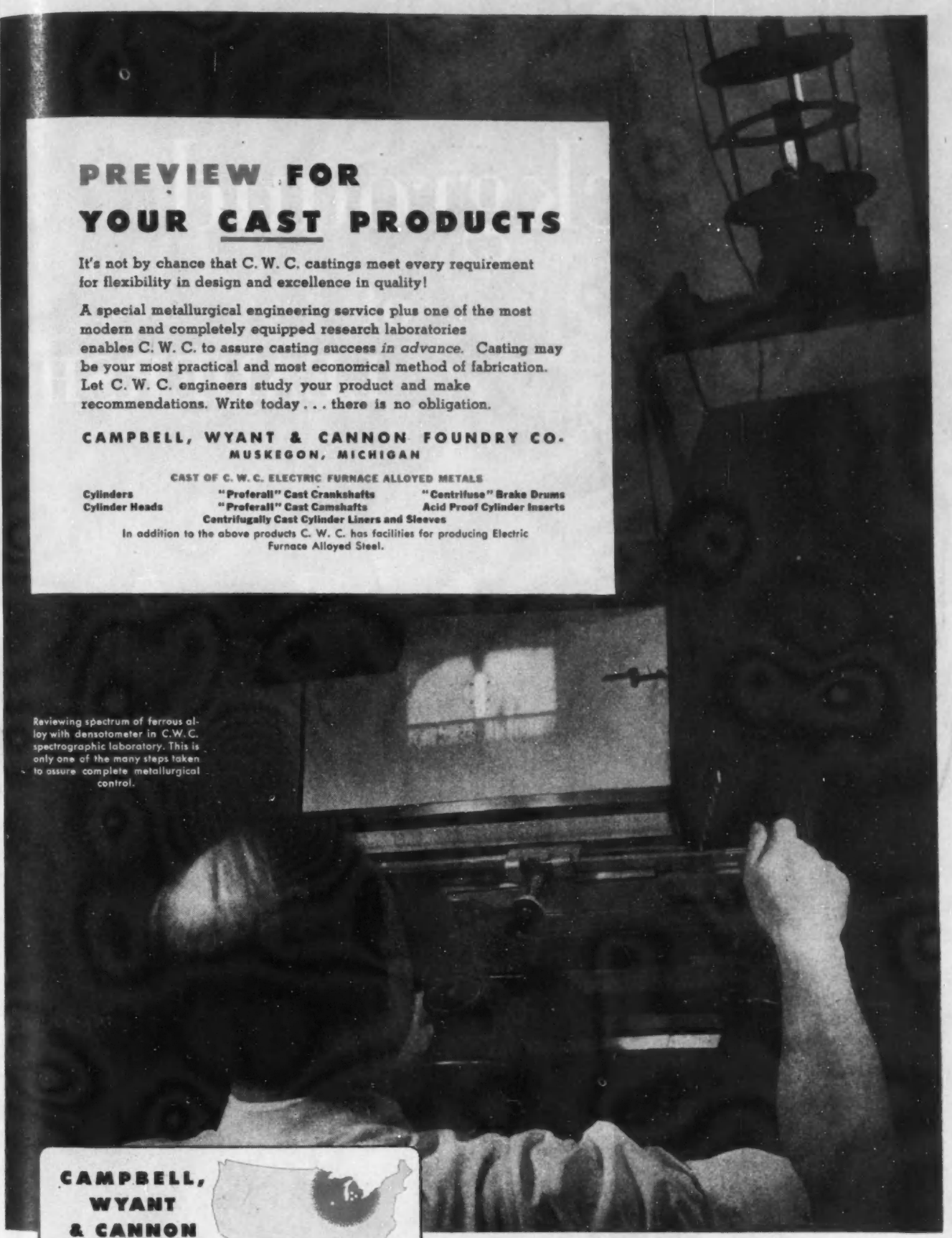
CAMPBELL, WYANT & CANNON FOUNDRY CO.
MUSKEGON, MICHIGAN

CAST OF C. W. C. ELECTRIC FURNACE ALLOYED METALS

Cylinders	"Proferall" Cast Crankshafts	"Centrifuse" Brake Drums
Cylinder Heads	"Proferall" Cast Camshafts	Acid Proof Cylinder Inserts

Centrifugally Cast Cylinder Liners and Sleeves

In addition to the above products C. W. C. has facilities for producing Electric Furnace Alloyed Steel.

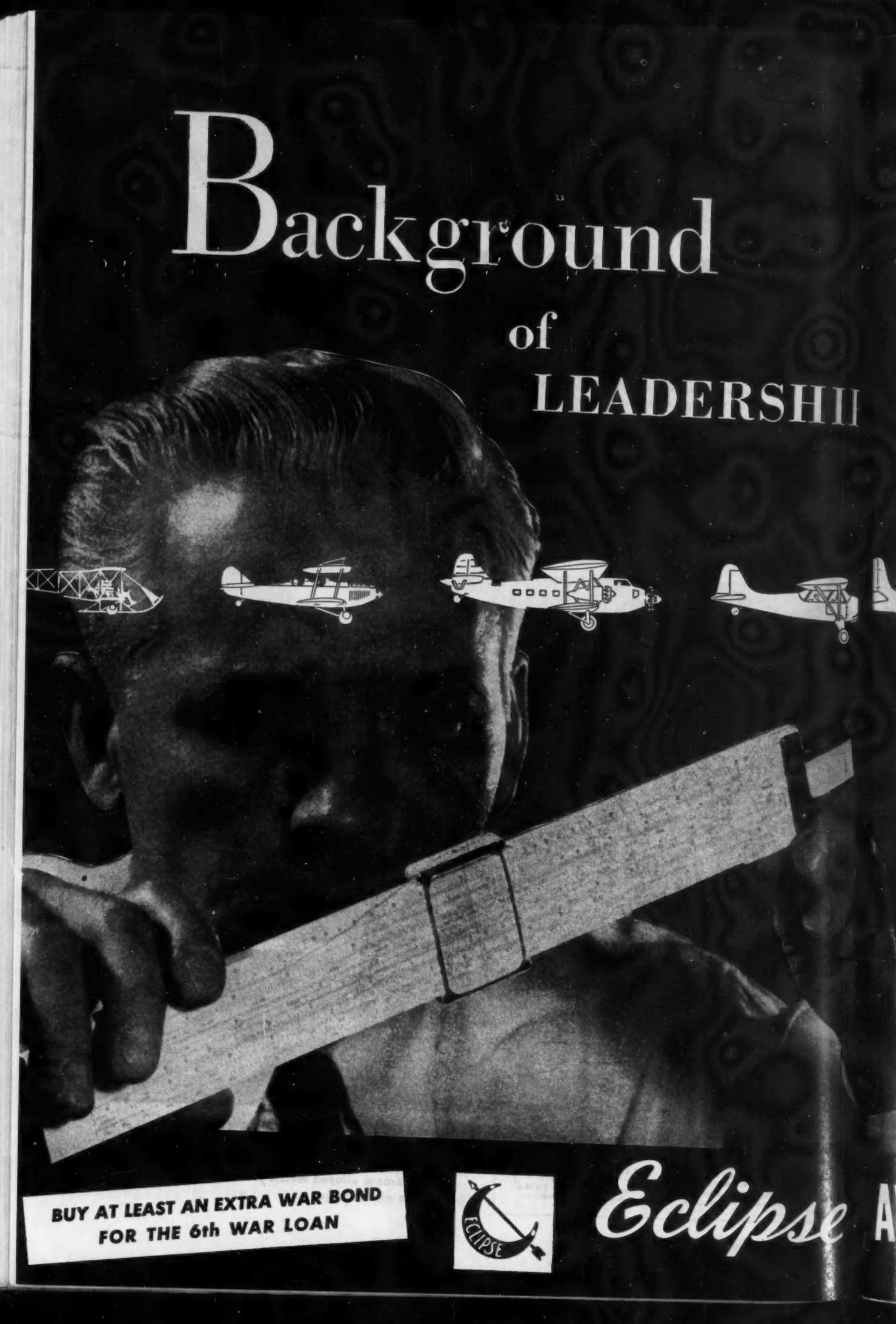


Reviewing spectrum of ferrous alloy with densotometer in C.W.C. spectrographic laboratory. This is only one of the many steps taken to assure complete metallurgical control.

CAMPBELL, WYANT & CANNON FOUNDRIES

- MUSKEGON, MICHIGAN — Henry Street Plant; Sanford Street Plant; C. W. C. Crankshaft Corp.
- SOUTH HAVEN, MICHIGAN — National Motor Castings Co.
- LANSING, MICHIGAN — Centrifugal Fusing Co.
- BETTENDORF, IOWA — Ordnance Steel Foundry Co.

Casting eliminates the restrictions upon design that are inherent in other manufacturing methods. C. W. C.'s revolutionary foundry practice and their development of new electric furnace alloyed metals provide physical properties otherwise unattainable.


Background
of
LEADERSHII
BUY AT LEAST AN EXTRA WAR BOND
FOR THE 6th WAR LOAN
ECLIPSE
Eclipse A

Eclipse Experience

EVERY ACCESSORY ANY PLANE NEEDS

AVIATION ACCESSORIES

Eclipse-Pioneer Division

Teterboro, N. J. • Los Angeles 38, Calif.

Bendix

AVIATION CORPORATION

For the New Tractors, a Revolutionary Hydraulic Disc Brake

that more than fulfills the Greatest Expectations of Tractor Users

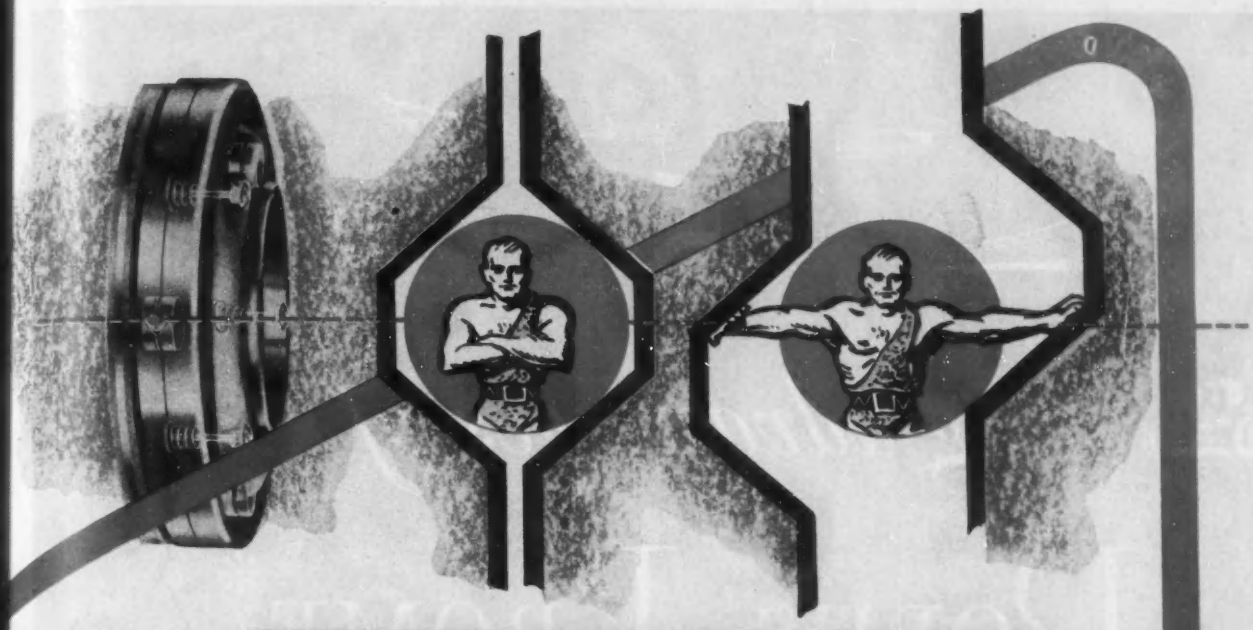
Among the many types of Disc Brakes developed by the engineers of the Auto Specialties Company and described in the new 36-page Data Book, now being placed in the hands of car, truck, bus, tractor, and aircraft engineers, is the Lambert Hydraulically Operated Disc Brake for Tractors.

In these Tractor Disc Brakes, tractor engineers will find the improved performance and extreme durability so long sought . . . brakes which harness momentum . . . brakes with greater braking power than much larger sized drum type brakes . . . brakes requiring less pedal pressure . . . brakes that solve the problem of equal efficiency in stopping backward and forward and forward motion . . . brakes that eliminate drum weight and scoring.

Engineers and planning committees charged with the responsibility for tomorrow's finer tractors, cars, trucks, buses, and aircraft are urged to write for a complimentary copy of the new Lambert Disc Brake Data Book.

AUTO SPECIALTIES MFG. COMPANY
ST. JOSEPH, MICHIGAN

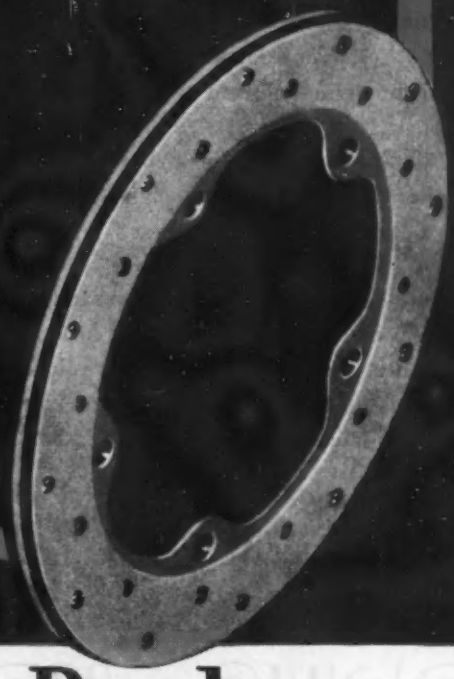
Disc Clutch
Lambert Disc Brake
Lambert Hydraulic Tractor
The Lambert Disc Brake
Hydraulic Operated
This Lambert Brake was especially designed for heavy duty tractor service. Its performance has been proven on a substantial number of tractors, pulling heavy trailed loads controlled only by the two brakes on the tractor drive wheels. It has shown again the importance of the Two Direction Feature, stopping with equally high efficiency both backward and forward motion, a distinct contribution to the ease and safety of tractor operation.



Energizing Discs HARNESS MOMENTUM

The application of initial power to the primary disc brings it in contact with the revolving friction ring. This contact imparts a slight rotary motion to the primary disc, causing the rollers or balls to move up the incline of the energizing discs thus creating additional braking power.

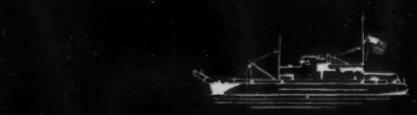
DISC Principle ELIMINATES BRAKE DRUMS not only saving on an average of approximately 84% of the weight of conventional brake drum and eliminating brake drum scoring but also providing greater braking surface contact.

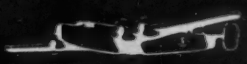


Lambert Disc Brakes

Air • Hydraulic • Mechanical

Products of a Division of the Auto Specialties Mfg. Co.





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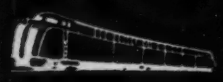


big advantages of

PORUS-KROME*

1 PORUS-KROME applied to the cylinder walls of gasoline and Diesel engines multiplies the life of the cylinders from 4 to 20 times.

2 PORUS-KROME on the cylinder walls multiplies the life of the ordinary piston rings from 3 to 5 times.

3 PORUS-KROME, with its thousands of tiny pores and channels which hold lubricating oil and feed it back as needed, improves lubrication and holds lubricating oil consumption at a constant low level.

4 PORUS-KROME and piston rings wear so slowly that high power development is maintained for many more hours . . . many more miles . . . than with ordinary cylinders.

5 PORUS-KROME means greater engine reliability because it reduces scoring and scuffing and the risk of piston seizure and because it cuts down the number of overhauls caused by cylinder and ring wear.

All of these advantages add up to a substantial saving in engine operating costs.

VAN DER HORST

U. S. PATENTS 2,040,676 AND 2,314,604

PORUS - KROME

Good for the Life of your Engines

* PORUS-KROME is pure, hard chromium which is applied to cylinder bores by the patented Van der Horst process. It has tiny pores and channels in its surface which serve as reservoirs for lubricating oil, feeding it back as needed. It reduces corrosion and wear and multiplies cylinder life 4 to 20 times.

VAN DER HORST CORPORATION OF AMERICA OLEAN • NEW YORK CLEVELAND 11 • OHIO

AN AFFILIATE OF DRESSER INDUSTRIES

Sealed~~~

● **Sealed orders** to safeguard the lives of men . . . men who have risked their lives in every age; in peace as in war; in their devotion to the progress of their fellow men.

Sealed Oil to safeguard the lives of men . . . to make possible speed. Speed on land and in the air; on the production line of giant industrial plants. Speed with the reassurance of safety.

National Oil Seals to keep that oil where it must stay for the safety of those men. Oil Seals . . . the answer to oil retention in modern machines . . . manufactured in the world's largest plants devoted exclusively to this job . . . the job of keeping oil in contact with the vital bearings that make possible the mechanical achievements of our day.

NATIONAL
OIL AND FLUID SEALS

Wherever shafts move

NATIONAL MOTOR BEARING CO., INC.
General Offices: Redwood City, California
Plants: Redwood City, California • Van Wert, Ohio

944

SHOCK!
STEEL
STEEL
METAL-TO-METAL contacts cause SHOCK . . VIBRATION . . NOISE . . WEAR . . DESTRUCTION!
RUBBER
RUBBER
RUBBER-TO-RUBBER contacts ABSORB shock . . . MINIMIZE vibration . . . MUFFLE noise . . . PROLONG LIFE of moving parts!
Cut-away view of threshing mechanism in a modern combine. Rubber faced steel cylinder bars, operating in connection with a rubber stripping plate, and two stationary block rubber concaves, protect hard and soft shell crops from damage.

SHOCK is the foe of machinery. SHOCK and resultant VIBRATION caused by metal-to-metal contacts of moving parts are fast being eliminated by modern processes of rubber-to-metal adhesion.

A "striking example" of metal-to-metal *versus* rubber-to-rubber contacts is the development of the modern combine or "all-crop harvester."

ORCO engineers, working closely with farm machinery engineers, applied modern rubber adhesion processes to eliminate metal-to-metal contacts in threshing mechanisms.

The "end result" was elimination of SHOCK which in old style harvesters limited the machines to hard shell crops and often caused damage to both crops and machines.

Rubber-to-rubber contacts now widen the scope of the modern combine to include soft shell as well as hard shell crops. Machines last longer. Crops are protected against crushing. Operators are relieved of fatigue caused by excessive noise and vibration.

When YOU encounter problems involving SHOCK and VIBRATION in moving parts of machinery, ORCO engineers are prepared to co-operate. Ask for ORCO-OPERATION!

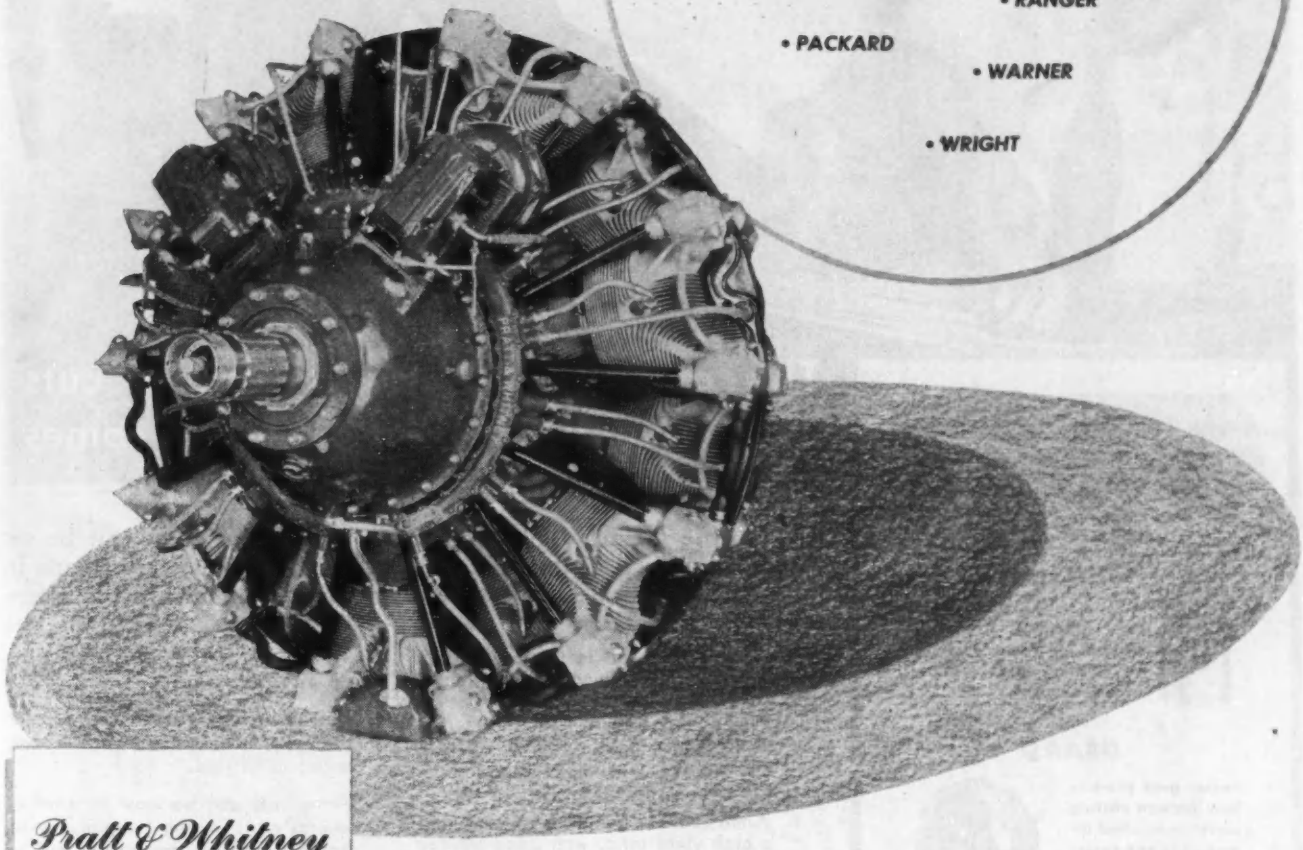
"ORCO-OPERATION"

THE OHIO RUBBER COMPANY · WILLOUGHBY, OHIO

BRANCHES: DETROIT · NEW YORK · CHICAGO · INDIANAPOLIS · WASHINGTON · CLEVELAND

Scintilla "sparks" the finest

- FRANKLIN AIRCOOLED
- KINNER
- CONTINENTAL
- JACOBS
- LAWRANCE
- LYCOMING
- PRATT & WHITNEY
- RANGER
- PACKARD
- WARNER
- WRIGHT



Pratt & Whitney

HORSEPOWER BY THE MILLION FOR THE PLANES OF WAR

On thousands of Pratt & Whitney-equipped bombers, fighters, trainers, cargo planes, and patrol craft, Bendix Scintilla aircraft ignition equipment delivers the vital spark.

"BENDIX-SCINTILLA" AND "SCINTILLA" ARE TRADEMARKS OF BENDIX AVIATION CORPORATION

ARMY E NAVY

SCINTILLA MAGNETO

DIVISION OF **Bendix** AVIATION CORPORATION

SIDNEY, N.Y.

Design that part in ArmaSteel*

The metal that boosts output, cuts costs, saves time, when "GO-Day" comes

IN THE AUTOMOTIVE AND DIESEL INDUSTRIES

PISTONS

A leading Diesel manufacturer has used ArmaSteel pistons for years, chalking up impressive records of continuous service.

GEARS

Faster gear production through casting closer to finished dimensions and easier machining is a leading advantage of ArmaSteel.

CLUTCH THROWOUT COLLARS

The special qualities of ArmaSteel well fit it for the heavy loads and wear to which throwout collars are subjected.

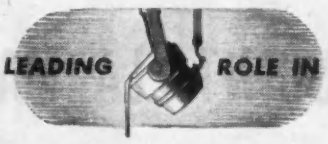
The time lag from plan board to finished product can be cut sharply with ArmaSteel, the metal that has proved its mettle in hundreds of strategic war uses. In your reconversion plans consider these factors:

1. ArmaSteel is cast to conform closely to final shapes, cutting machining time, lowering cost of manufacture and reducing scrap loss.
2. ArmaSteel is much easier to machine than steel bar stock and forgings of the same Brinell hardness.
3. ArmaSteel has a uniform structure and a high yield ratio, with good fatigue and wear properties.
4. ArmaSteel responds to selective hardening by any of the commercial processes, such as induction, flame-hardening or bath immersion.
5. ArmaSteel maintains its properties at sub-zero temperatures.
6. ArmaSteel may be machined and polished to the mirror finishes so necessary to reduce friction.
7. ArmaSteel can be cast to combine several parts in one integral casting, thereby reducing machining and assembly costs.
8. ArmaSteel can be heat-treated to cover a wide range of physical properties.

Leading manufacturers have proved ArmaSteel to be an exceptionally versatile material, adaptable to varied requirements and lending itself to time-saving techniques.

Investigate ArmaSteel. It may effect savings and improvements in your product. Write us, detailing your requirements. Specify ArmaSteel in your reconversion plans.

BUY ANOTHER WAR BOND FIRST



SAGINAW MALLEABLE IRON DIVISION OF GENERAL MOTORS

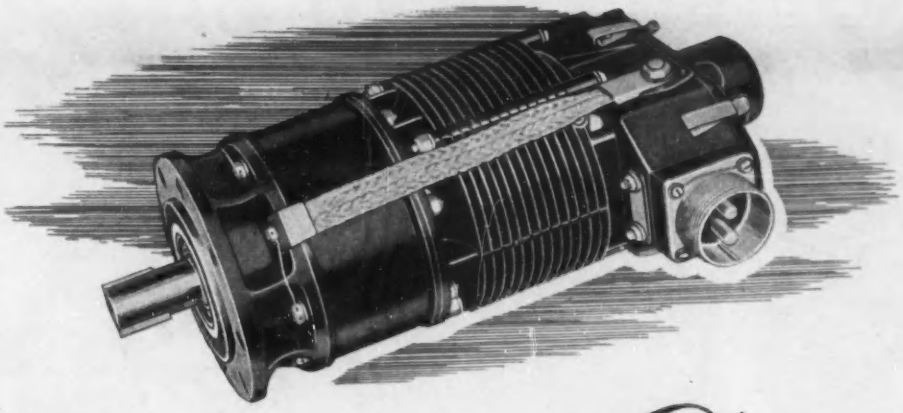
SAGINAW, MICHIGAN

*Reg. U. S. Pat. Off.

OR AIRCRAFT ENGINES...AN AIRCRAFT SPARK PLUG
First...Reliability
BG
Above all else, BG Spark Plugs are built to be *reliable*. Their advantages include economy of flight operation and more flying hours per plug—but *reliability of performance* is the big consideration. For this they were designed by aircraft spark plug specialists, and so that you can be sure yours are reliable, each BG plug is inspected and tested many times during its manufacture.
This inbuilt reliability is one of the reasons why BG Spark Plugs have been standard airline equipment for many years.
BG
ARMY
E
NAVY
THE BG CORPORATION
136 WEST 52ND STREET, NEW YORK 19, N. Y.
Manufacturers of both mica-insulated and ceramic-insulated aviation spark plugs
Contractors to the United States Army, Navy and Coast Guard and Aircraft Engine Builders

The 5-Week Miracle

THAT



SPEEDS AID TO CHINA

CAN ENGINEERING SPEED LIKE THIS HELP YOU?

STRANGE contrast to China's teeming millions and primitive hills, the Superforts are speeding vital aid for a gallant ally. To a patient, long-suffering people, these sky giants symbolize freedom and new hope . . . and America poured forth many a miracle of ingenuity to hasten their coming. For example, when the original retraction motors used on the first B-29's proved inadequate to raise and lower the huge landing wheels, something had to be done—*and in a hurry.*

In three weeks, Jack & Heintz engineers designed and built a test motor for the job. Specifications called for 5,000 cycles of operation without stop; the Jack & Heintz unit delivered 20,000. In two weeks more, *production* models were delivered for installation. Today, thousands of these Jack & Heintz motors are in service. This is only one of the 20 Jack & Heintz products used on the B-29.

This ability to solve a tough precision engineering and manufacturing problem quickly has been of great value in war production. It can be equally effective in attacking the complex technical problems that must be solved almost overnight if reconversion is to be speedy and successful.

★ ★ ★

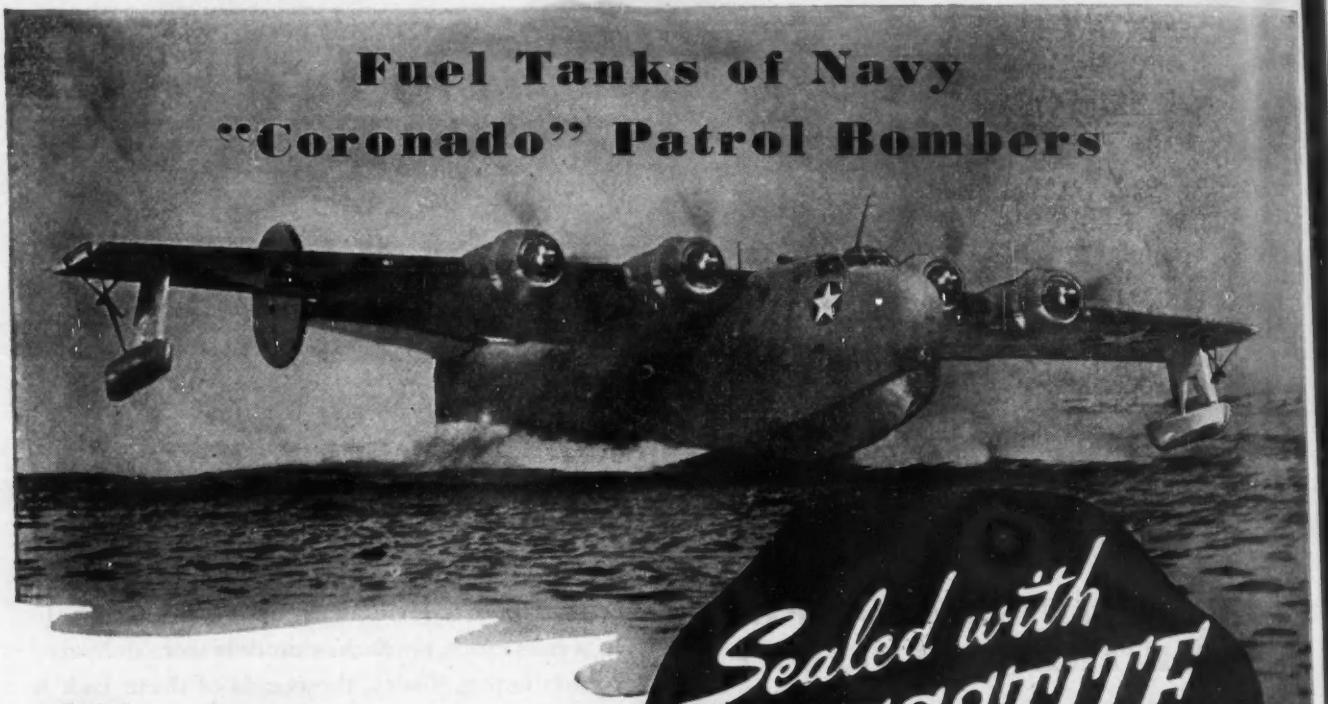
Jack & Heintz, Inc., Cleveland, Ohio, manufacturers of aircraft engine starters, generators, gyro pilots, gyro flight instruments, magnetos, motors.

JAHCo

JACK & HEINTZ

Incorporated

Fuel Tanks of Navy "Coronado" Patrol Bombers



Sealed with PRESSTITE SEALING COMPOUNDS

Many a tale has been told of the great work being accomplished by the Navy's PB2Y's—known as "Coronado" Patrol Bombers—in jobs ranging from bombing missions to heroic surface rescues. The fuel tanks of the Navy transport version of this type of plane, designated PB2Y-3R, are resealed by the Rohr Aircraft Corp. of Chula Vista, California.

Integral Fuel Tanks in these giant ships, the largest mass-produced plane in Navy service, are sealed with Presstite sealing materials using the Rohr Tank Seal Process. This method of sealing integral tanks, developed by Rohr Aircraft Corp., using these proven Presstite materials, represents the latest development in sealing tanks in large transport, cargo, and similar type planes.

Meeting the complex sealing requirements of the aircraft industry is only one example of Presstite's ability to originate and develop sealing compounds for specific requirements.

If your product or your manufacturing processes call for sealing or coating compounds, send your requirements to sealing specialists. We'll gladly work with you and your engineers in suggesting the most effective compounds to fit your needs.

PRESSTITE SEALING COMPOUNDS

PRESSTITE ENGINEERING COMPANY, 3900 Chouteau Avenue, St. Louis 10, Missouri

A Partial List of Industries for Which Presstite has successfully Developed Special Sealing Compounds:

For the Aircraft Industry:
Sealers for
- Integral Fuel Tanks
- Fuselage Seams
- Drop-off, Expendable Fuel Tanks
- Gun Turrets
- Synthetic Glass
- Instruments
- Intercoolers
- Air Ducts
- Insulating Dissimilar Metals
- Seaplane Floats

For the Refrigeration Industry:
Sealers for Domestic and Commercial Refrigerators
Bonding and Sealing Low Temperature Insulation in Refrigerated Rooms

For the Railroads:
Sealers for Insulating, Soundproofing and Weatherproofing of Railway Cars—Sealing Car Windows and Spot Welded Seams

For the Building Industry:
Roof Coatings, Caulking, and Waterproofing Compounds

For the Shipbuilding Industry:
Insulation Adhesive and Sealers — Rust Preventive Compounds

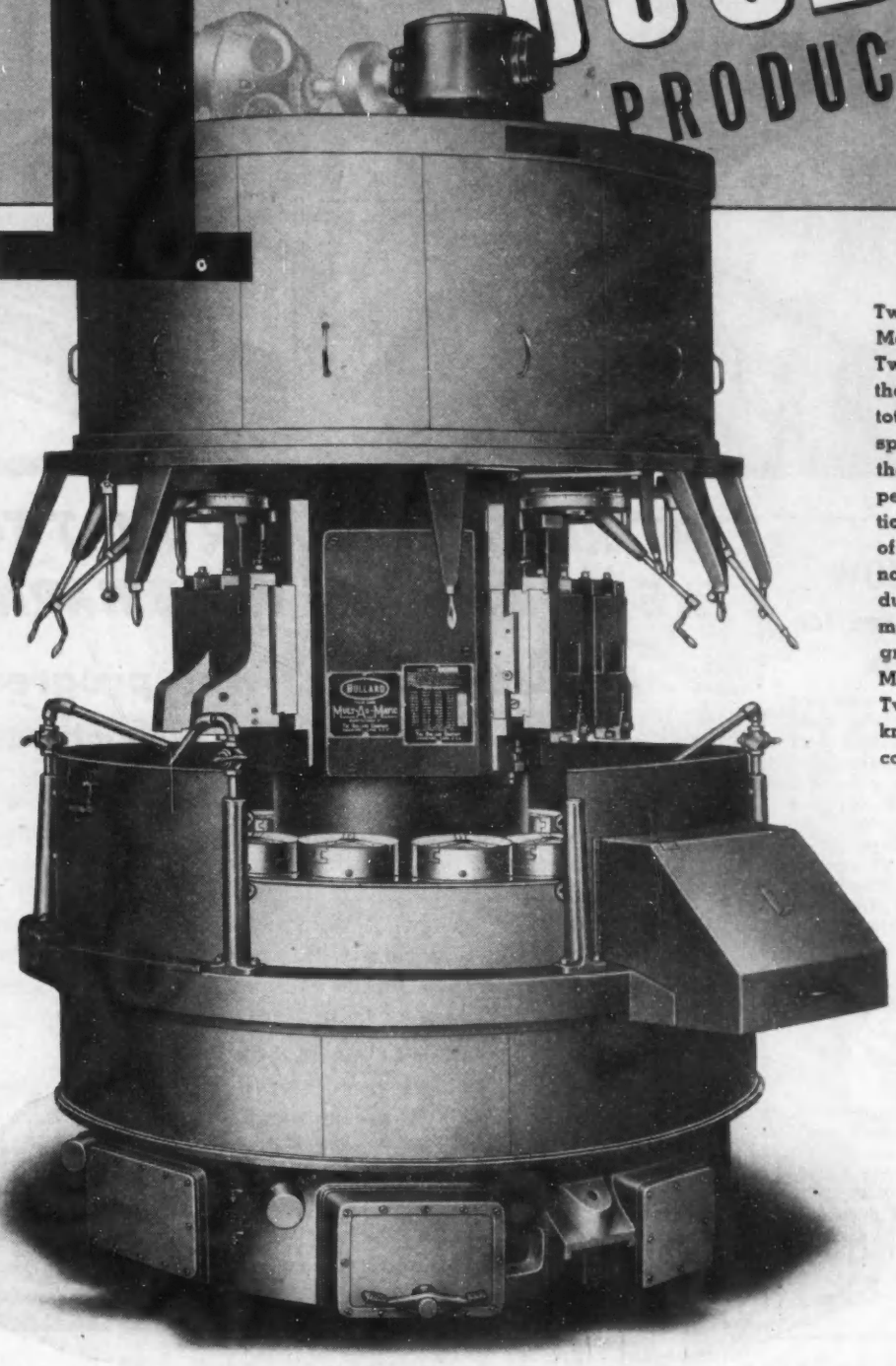
For the Automotive Industry:
Special Adhesives and Sealers

For the Construction Industry:
Sealers for Jointing Sewer Pipes
Sealers for Waterproofing Excavation Work

Miscellaneous:
For Glazing Greenhouse Windows
Extruded Caulking Compounds
Ammunition Paints
Plus Many Special Products for the Army and Navy

Our Engineering, Technical, and Laboratory facilities are at the service of any industry with a sealing problem.

1 MACHINE DOUBLES PRODUCTION!



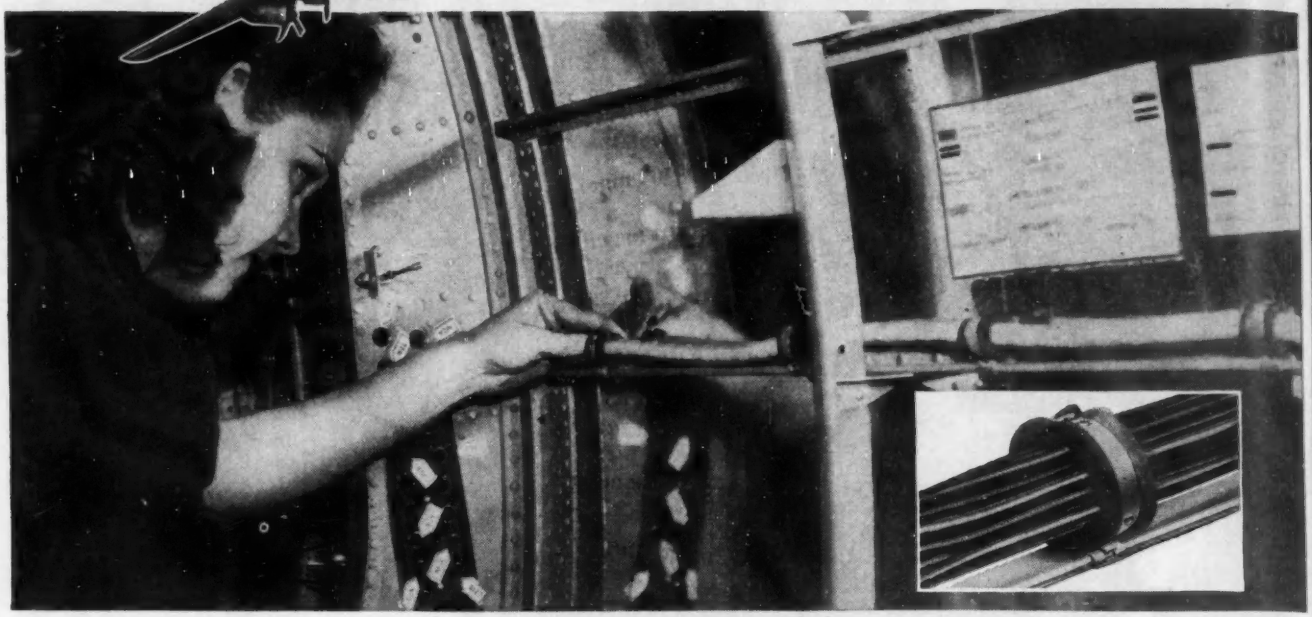
Twin Spindle Mult-Au-Matics—The Faster Method. Twin spindles at each of the 6 or 8 stations give a total of twelve or sixteen spindles. Twin tooling on the head at each station performs identical operations on the work in each of the twin chucks. This naturally doubles the productive output from one machine at only a slightly greater investment. One Machine—One Operator—Twice the Volume. That's knocking down production costs.

Write Bullard for details. Circular TR-DF-1.

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

Girl in bomber fuselage is tightening one of the hundreds of wire harness bands used on each Boeing B-29 Superfortress. Bands are supplied by United-Carr Fastener Corp. Each band is lined with cellular rubber, produced by Sponge Rubber Products Co., to cushion, insulate and prevent chafing. Parts are small – but they do a big job in protecting wiring against vibration of four 2200 h.p. motors and the recoil of Superfortress guns.



AVAILABLE NOW

Specially Compounded for Automotive Use

We can accept your order now for sheet sponge rubber specially compounded for automotive use. Resists gasoline, oil, and corrosive vapors, and abrasion. Supplied in sheets of any desired length, as hard or as soft as required. Use it to insulate, block sound transmission, cushion floors, line trunks, seal out moisture, dampen vibration. You can also have die cut pieces, molded parts, continuous strips or cords compounded to meet your special requirements. Tell us your problem; our staff, with long experience in serving America's leading automobile manufacturers, will help you solve it quickly, economically, efficiently.

THE RUBBER COLLAR THAT TOOK THE 'RUB' OUT OF WIRE HARNESS

. . . A lesson in post-war progress from a Boeing Superfortress

The tiny strips of cellular rubber that cushion the hangers for wires in the B-29 Superfortress cost just a few pennies. But what a man-size job they do! They soak up vibration . . . prevent chafing . . . keep wires in condition to "keep 'em flying"!

Wherever there is a danger of vibration – in an automobile, an airplane, a railroad train, a machine tool, a home appliance – *any* motor-driven piece of equipment – similar applications of cellular rubber can lengthen the life of equipment; help assure trouble-free operation.

Two Basic Types Available

Our organization, with 21 years' experience compounding sponge rubber (Spongex*) also produces another basic type of *cellular rubber* – Cell-tite*. In Spongex, the most familiar type of this material, the cells inter-connect. In Cell-tite the cells are individual, separate, filled with inert gases.

Consult us *now* if you need any variety of cellular rubber. We are able and ready to help you solve any problem of sealing, cushioning, vibration dampening, sound deadening, insulating, and have ample production facilities to meet your present and post-war needs.

* Trade Mark Registered

Sponge Rubber Products Co.

102 Derby Place, Shelton, Conn. • Plants in Derby and Shelton, Conn.

Sales Offices: NEW YORK • CHICAGO • WASHINGTON • DETROIT

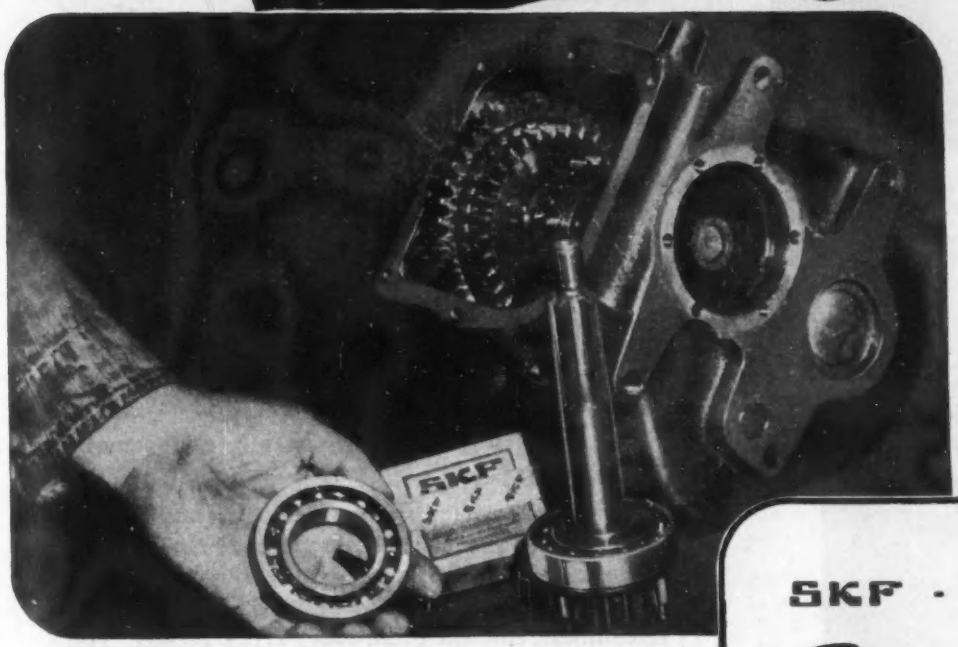
World's Largest Manufacturer of Cellular Rubber Products

FLEET *costs*

GO DOWN—STAY DOWN

If there's any part of a truck or a bus that takes a beating, it's the transmission. Because of their accuracy, low maintenance and carefree operation, SKF Bearings are ideal for this important location. As a result, many fleet superintendents insist upon replacing with SKF's for efficient, quiet and smooth-running transmissions. When *bearing* maintenance costs stay down, so do *fleet* maintenance costs. 5630

SKF INDUSTRIES, INC., PHILADELPHIA 34, PA.



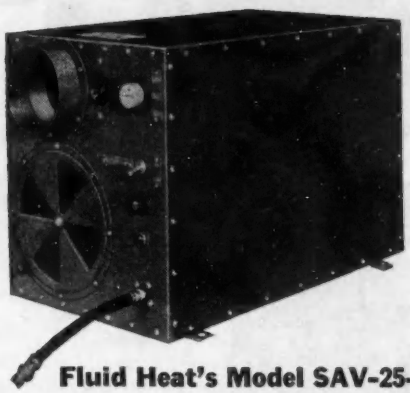
ARMY E NAVY

SKF - EQUIPPED

Transmission

for trucks
used by Highway Express

fluid heat
TRUCK HEATERS DO
a 4-Way Heating Job!



Fluid Heat's Model SAV-25-110

This model illustrates the flexibility of Fluid Heat's heat engineering know-how. Designed by request for use in trailers housing mobile laboratories, it operates on 110 A. C. and delivers 25,000 BTU per hour. Fuel is drawn directly from the tank of the vehicle. Dimensions are 17 15/16 by 10 1/4 by 12 1/16 inches.

Fluid Heat's Model SAH-15T

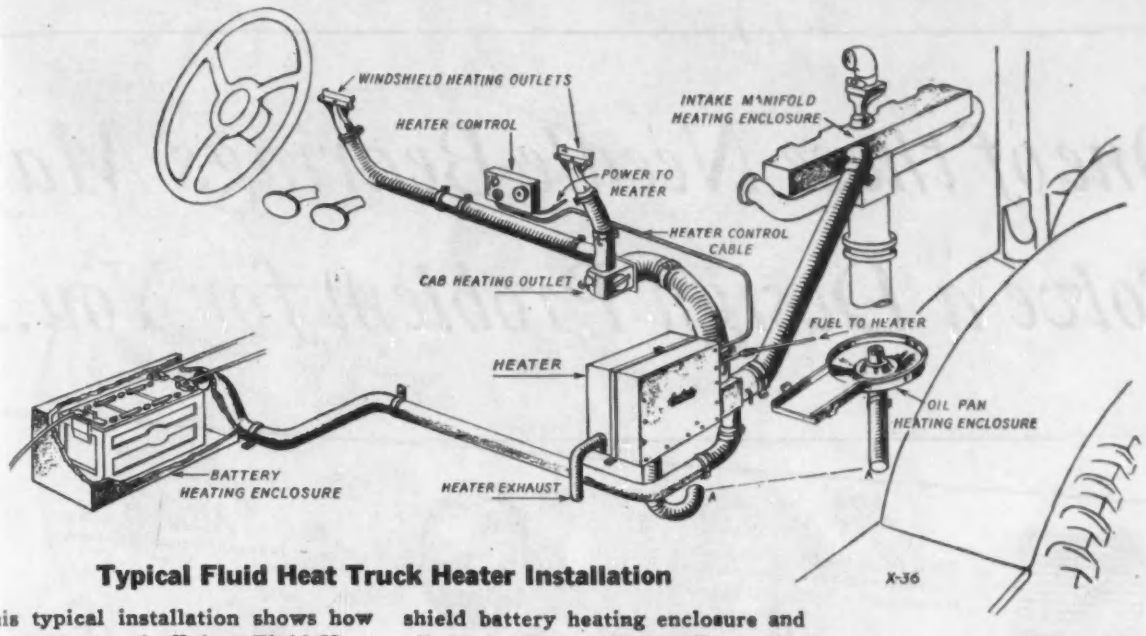
Designed for trailer and cargo-space heating, this model has an output of 15,000 BTU per hour and has a convenient hand-replenished fuel tank compactly built onto the top. Built-on tank makes the heater a completely independent, self-contained unit, permitting uncoupling of trailer without fussing with fuel lines.

FLUID Heat Truck Heaters do a four-way heating job on trucks, trailers and busses. They warm the operator's cab and defrost windshields, heat cargo or personnel space, produce quick and effortless cold-weather starting by preheating batteries, engine manifold and crank case. Mounted on wheels or runners, they preheat engines of bulldozers, cranes, compressors and other machinery where heat is an aid to starting or operating. They are ideal for vehicles where men or machines require heat to operate most efficiently and economically.

Fluid Heat Truck Heaters fit compactly in the chassis, or in cargo or living space. They control from the heater itself or from the dash. They burn any grade of gasoline, drawing direct from the vehicle's fuel supply or from built-in fuel tanks of their own. The new and exclusive combustion process of *vapor entraining*, proved in Fluid Heat Aircraft Heaters, assures maximum combustion efficiency, freedom from lead oxide formation, longer life for burner parts. There are only three moving parts—motor, fan, standard automotive-type pump.

Fluid Heat has, for sixteen years, pioneered in the development and manufacture of automatic combustion and heat transfer equipment. Those years of heat engineering know-how are built into each compact, economical, efficient Fluid Heat Truck Heater. You'll want Fluid Heat Truck Heaters on the trucks, trailers, busses, cars or other vehicles you design, build or equip. Write for full information on this new heat engineering achievement.

FLUID HEAT DIVISION
Anchor Post Fence Co.
6770 Eastern Ave., Baltimore 24, Md.



Typical Fluid Heat Truck Heater Installation

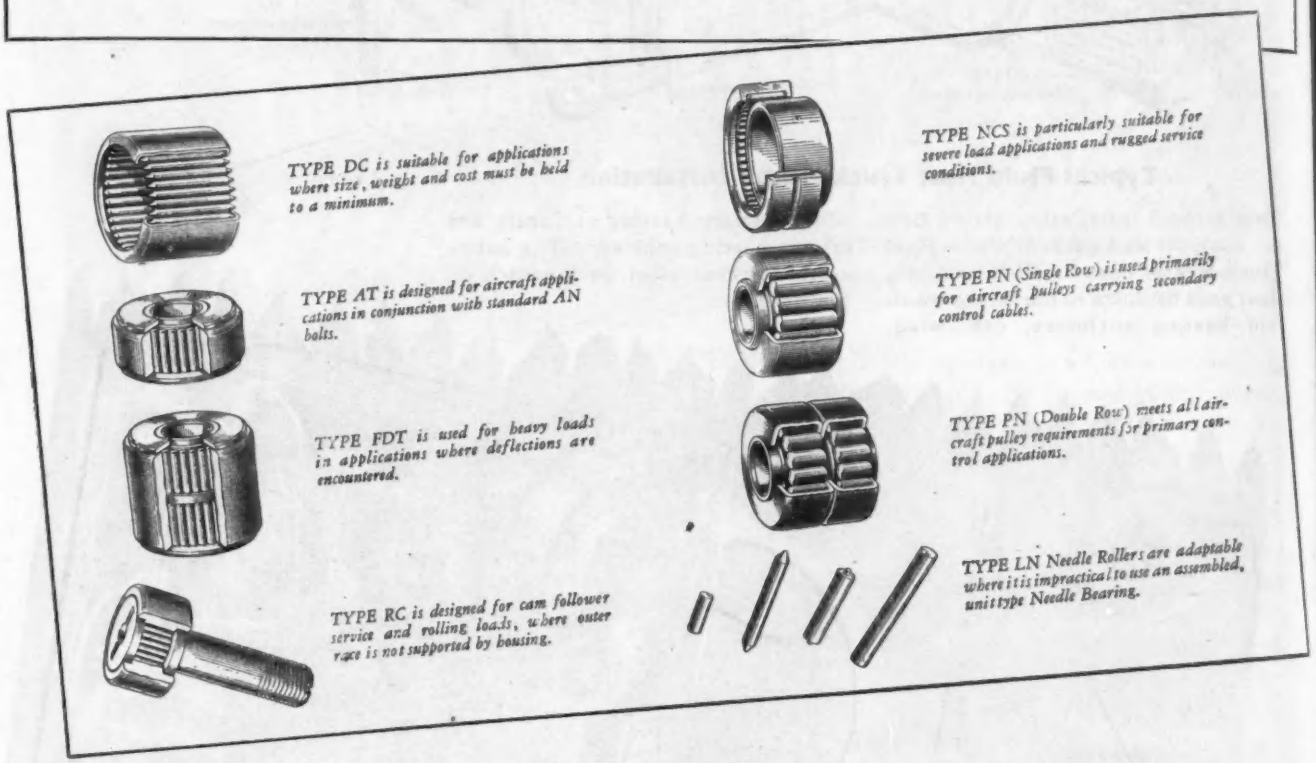
This typical installation shows how the compact and efficient Fluid Heat Truck Heater does its all-around job. Heat goes by ducts to the intake manifold heating enclosure, cab, windshield battery heating enclosure and oil pan heating enclosure. The entire system is controlled by a switch on the dash.

Fluid Heat's New Model SAH-20 Truck Heater

This heater has a maximum output of 20,000 BTU per hour, yet weighs only 21 pounds, fits easily on any truck. Overall dimensions are 7¼ inches wide, 10½ inches high, 12 inches long. To insure clearance, heater can be placed in almost any position. Pump enclosed in the unit draws fuel direct from the truck's fuel tank. All models operate on 6, 12 or 24 volts D. C. or 110 volts A. C. Model SAH-40, not shown on these pages because it is identical in design, delivers 40,000 BTU per hour. It is 13 inches by 10½ inches by 19 inches, weighs 40 pounds.

fluid heat
TRUCK HEATERS

One of these Needle Bearings May Solve a Design Problem for You...


TYPE DC is suitable for applications where size, weight and cost must be held to a minimum.
TYPE AT is designed for aircraft applications in conjunction with standard AN bolts.
TYPE FDT is used for heavy loads in applications where deflections are encountered.
TYPE RC is designed for cam follower service and rolling loads, where outer race is not supported by housing.
TYPE NCS is particularly suitable for severe load applications and rugged service conditions.
TYPE PN (Single Row) is used primarily for aircraft pulleys carrying secondary control cables.
TYPE PN (Double Row) meets all aircraft pulley requirements for primary control applications.
TYPE LN Needle Rollers are adaptable where it is impractical to use an assembled, unit type Needle Bearing.

It may not have occured to you that there are so many *different* types of Needle Bearings—or that the completeness of the line of these modern, antifriction bearings makes them adaptable to many design requirements.

Pictured above are eight different types—all different in design yet employing the same basic design principle of a full complement of small diameter needle rollers. Each is engineered for a particular task—or combination of design requirements. Individually each offers the same characteristic advantages of compact design, small size, light weight, high capacity, efficient lubrication and low cost.

The result is that in almost any application where Torrington Needle Bearings are employed, the design problem is simplified; operating efficiency and service life are increased; manufacturing costs are reduced, and sales features are added.

Investigate for yourself how these advantages can be of assistance in your product planning. The Torrington Needle Bearing Catalog 30-A gives complete information, and our engineering staff is ready to help you with any specific design requirement.

THE TORRINGTON COMPANY

Established 1866 • Torrington, Conn. • South Bend 21, Ind.

"Makers of Needle Bearings and Needle Bearing Rollers"

New York Boston Philadelphia
Detroit Cleveland Seattle
San Francisco Chicago Los Angeles
Toronto London, England

TORRINGTON

NEEDLE BEARINGS

FOR TOP-FLIGHT PERFORMANCE

90%

of all

Aircraft carburetors

built

are made by STROMBERG

Those who are intimately acquainted with the aircraft industry know that year-after-year acceptance of a product does not come by chance or luck. The accepted product holds its place on merit alone.

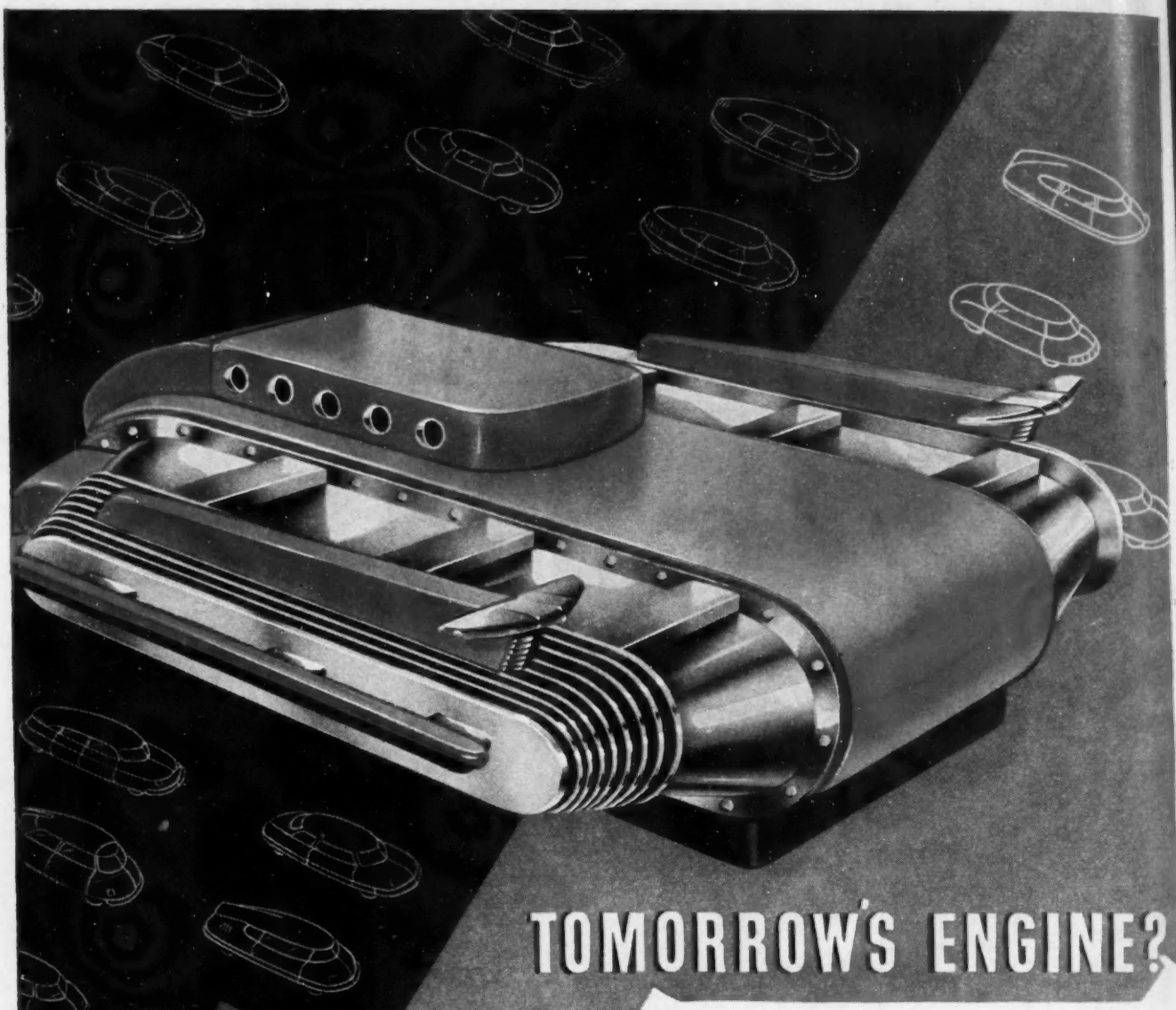
Nor does success in one year guarantee success in the next. The vigilant eyes of the industry keep constant watch. The inferior product is dropped as quickly as its shortcomings are discovered. The good product yields its place to the better. In this ceaseless struggle for survival, only the best remains in use.

There is, then, in these inflexible statistics, a story of product excellence far beyond the power of mere words to describe:

For the past ten years, the aircraft industry has preferred Stromberg to all others by 8 to 1. 90% of all Aircraft Carburetors built are made by Stromberg.

Bendix PRODUCTS DIVISION

Bendix Aviation Corporation, South Bend 20, Indiana



TOMORROW'S ENGINE?

BOHN

MECHANIZED warfare has had a tremendous effect on the development of internal combustion engines. The lessons now being learned will appear in concrete form in the motor car engines in the after-the-war era. One thing that is definitely sure is that new engine designs will furnish greatly increased horsepower per pound of engine weight. Engines will be smaller and by the greater use of aluminum alloys, will be considerably lighter. Bohn—one of the pioneers of light alloy parts for automobile engines—will be in the forefront in aiding these new developments.

BUY WAR BONDS

BOHN ALUMINUM AND BRASS CORPORATION • DETROIT 26, MICH.

GENERAL OFFICES—LAFAYETTE BUILDING

Designers and Fabricators—ALUMINUM • MAGNESIUM • BRASS • AIRCRAFT-TYPE BEARINGS

BRING ON YOUR VIBRATION!

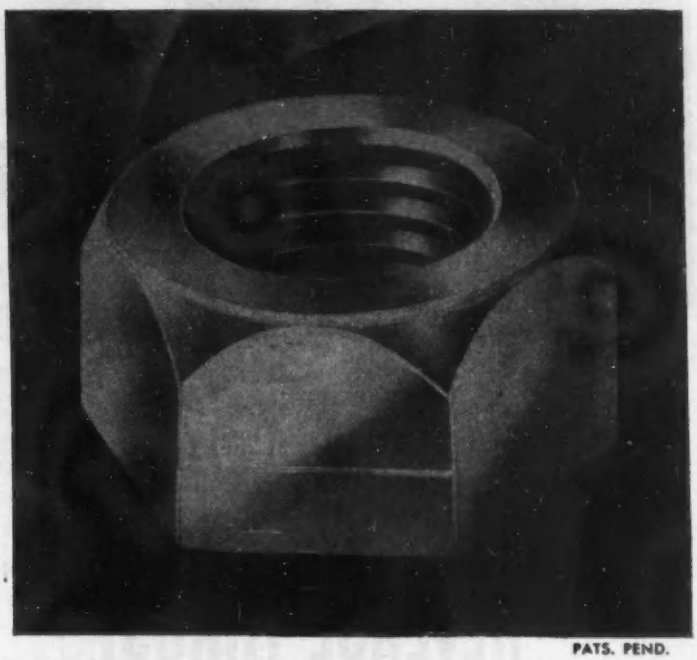
THE STOVER SELF-LOCKING NUT can "take it"!

When you have tested this *new-principle* self-locking nut, you will understand the true meaning of vibration resistance. You will see a precision-made nut which has been transformed into a powerful, metal spring. You will see the natural elasticity of metal employed to provide a mighty *grip* that defies vibration.

And yet the STOVER Self-locking Nut is a simple thing. It is in one piece with no complicated assembly. It does the whole job by itself. It locks at any point desired on the bolt and does no harm to the bolt threads. It can be used over and over without substantial loss of efficiency. It is made in standard sizes and threads from ¼ inch to 1½ inches. Finally, it costs no more than older-type less efficient lock nuts.

Send for descriptive literature and samples.

STOVER
"IT WON'T SHAKE LOOSE"



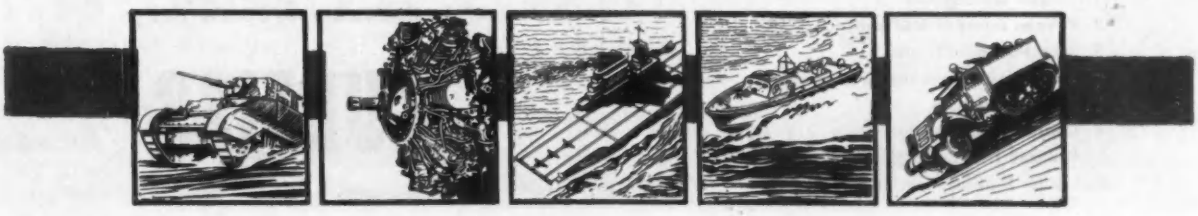
PATS. PEND.

MEETS ARMY AND NAVY SPECIFICATIONS

The STOVER Self-locking Nut is eliminating the loosening effect of vibration on many machines of war. Study it in relation to your postwar planning.

STOVER LOCK NUT AND MACHINERY CORPORATION

Easton, Penna., Bushkill Drive • New York 17, N. Y., 101 Park Ave.
REPRESENTATIVES IN PRINCIPAL CITIES



Now...
Aerodynamic Braking by
REVERSE THRUST

Aerodynamic braking, another first by Curtiss, brings to the science of flight a new and significant development. The propeller, long the source of forward thrust in aircraft, now provides thrust in reverse to reduce the landing roll of the airplane smoothly and surely, regardless of ground friction. Aerodynamic braking, like many other features, is inherent in the versatile Curtiss design.

Features of Aerodynamic Braking

1. Shorter landing roll
2. Greater safety of dual braking system
3. Smoother deceleration
4. Greater safety on slippery runways
5. Shorter taxi time
6. Unassisted ground handling
7. Reduced tire and brake wear
8. Lighter brake system possible

CURTISS ELECTRIC PROPELLERS

Curtiss-Wright Corporation • Propeller Division

Fox Hole Fog Generator

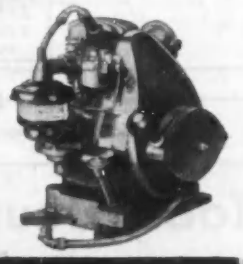
No larger than a soldier's foot locker, the M-2 bantam smoke generator can make fog from a foxhole. Its mobility brings large-area smoke screens to beachheads, mountain passes and jungle trails for the first time in history.

Smoke-screen protection for front line and amphibious operations, where space is at a premium, is provided for the first time by the new, highly mobile M-2 mechanical smoke generator. Weighing only 180 pounds, this midget can blot out, under favorable wind conditions, an area five miles long and 200 yards wide.

The Lauson single cylinder air-cooled gasoline engine powering the unit is specially designed for military use. Operating efficiency of the engine is safeguarded against extreme conditions of dust and other atmospheric impurities by a United Oil Bath Air Cleaner. Thousands of similar engines are in use by the Air Forces, Chemical Warfare Service and Navy on a variety of applications.

Many new uses in industry and agriculture for small power units like this will result from their ingenious applications to military purposes. And the same standards of performance which have distinguished United products used on war equipment and on cars and trucks, on tractors and farm machinery for over 19 years, will be ready for high-production needs tomorrow.

A Lauson RS special one cylinder gasoline engine made of aluminum operates the unit, consisting of boiler, blower and gear pump; it makes smoke in 40 seconds from a cold start.



Dust protection is afforded by the United Oil Bath Air Cleaner Model H30-12480 shown above.

UNITED SPECIALTIES COMPANY

UNITED AIR CLEANER DIVISION
CHICAGO 28, ILLINOIS

MITCHELL DIVISION
PHILADELPHIA 36, PA.

AIR CLEANERS ★ METAL STAMPINGS ★ HIGH PRESSURE HOSE CLAMPS ★ IGNITION SWITCHES ★ ROLLED SHAPES ★ DOVETAILS

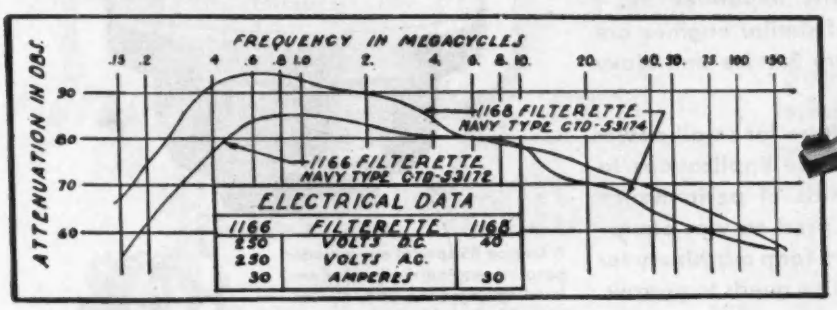
IN THE FIELD OF RADIO NOISE ELIMINATION TOBE IS THE ACKNOWLEDGED LEADER

One engineering result of the war is increased knowledge of radio interference problems. It will never be lightly treated again. No engineer can tackle the development of an electrical design without giving due consideration to minimizing the radio interference it creates in operation. Specially designed filters, to be built into electrical circuits, can usually solve the problem of radio interference.

Here at Tobe is a great storehouse of knowledge in this subject. It is *sound* knowledge, gained by the most intense interest and experience of any company in the field.

Tobe Filterizing is a copyright term. It means that Tobe knows how to "filterize" man-made radio noise. Why not make use of this valuable 16 years' of experience in your own engineering? Place your reliance on Tobe and the famous Tobe Filterettes. Send us your problems now.

LONG LIFE ASSURED!



CONTAINER DIMENSIONS

Length . . 4 7/16" Width . . 2 1/8" Height . . 2 7/8" Overall length 6 1/4"

SUPPRESS MAN-MADE RADIO STATIC

TOBE FILTERIZED

Tobe Deutschmann Corporation

CANTON, MASSACHUSETTS

A small part in Victory Today — **A BIG PART IN INDUSTRY TOMORROW**

An Eternity of Twenty Seconds

WHAT caused the ship to explode no one will ever know. One moment the bombardier was peering down at England three miles below—an instant later he was enveloped in a flash of flame and the B24 Liberator was breaking up in midair. He dived through the door in the nose compartment but his parachute caught on a cable and he hung, fighting desperately to climb back as the disintegrating ship plummeted down. Somehow he managed to pull himself up far enough to free the cable from his chute and dropped—now less than 1,000 feet from the ground. He landed hurt, but safe—one of only two survivors out of the crew of ten.

Before his enlistment, this bombardier was one of our younger employees in our Replacement Parts Division, typical of the fine type of up-and-coming American boys who are hand-picked by Thompson for training and development into positions of trust and responsibility.

In a letter to his former department head, he says, "Only by the grace of God I escaped. *The shock of the loss of those wonderful companions in our crew, I can't get out of my mind. Their screams still ring in my ears . . . I wish the people back home could realize the terrific turnover of materiel and supplies over here. Maybe then we wouldn't read some of the things that make us wonder . . .* "

The workers at Thompson truly have had a part in every bombing raid their former fellow worker has flown, for many of the 1,000 different aircraft parts and accessories made by Thompson go into the American Liberators, Fortresses and the U. S. fighting planes that fly with them as protection on their missions. *Since Pearl Harbor not one hour's production time has been lost.*

Yet, all we may do is so little compared to the risks, the sufferings and sacrifices our boys overseas are making. Someday we shall welcome these boys back. Only by giving them every ounce of support now can we then look them in the eye and grip their hands in honesty and sincerity.

Beating Production Schedules on Vital Parts for Planes, Tanks, Submarines, PT Boats, Torpedoes, Jeeps, Half-Tracks, Tractors, and Trucks

Thompson Products, Inc.

THOMPSON AIRCRAFT PRODUCTS CO.

MANUFACTURERS OF AUTOMOTIVE AND AIRCRAFT PARTS • GENERAL OFFICES: CLEVELAND • PLANTS IN OHIO, MICHIGAN, CALIFORNIA, AND ONTARIO, CANADA.

-without a shadow of doubt

THE PORTABLE PYROMETER POTENTIOMETER

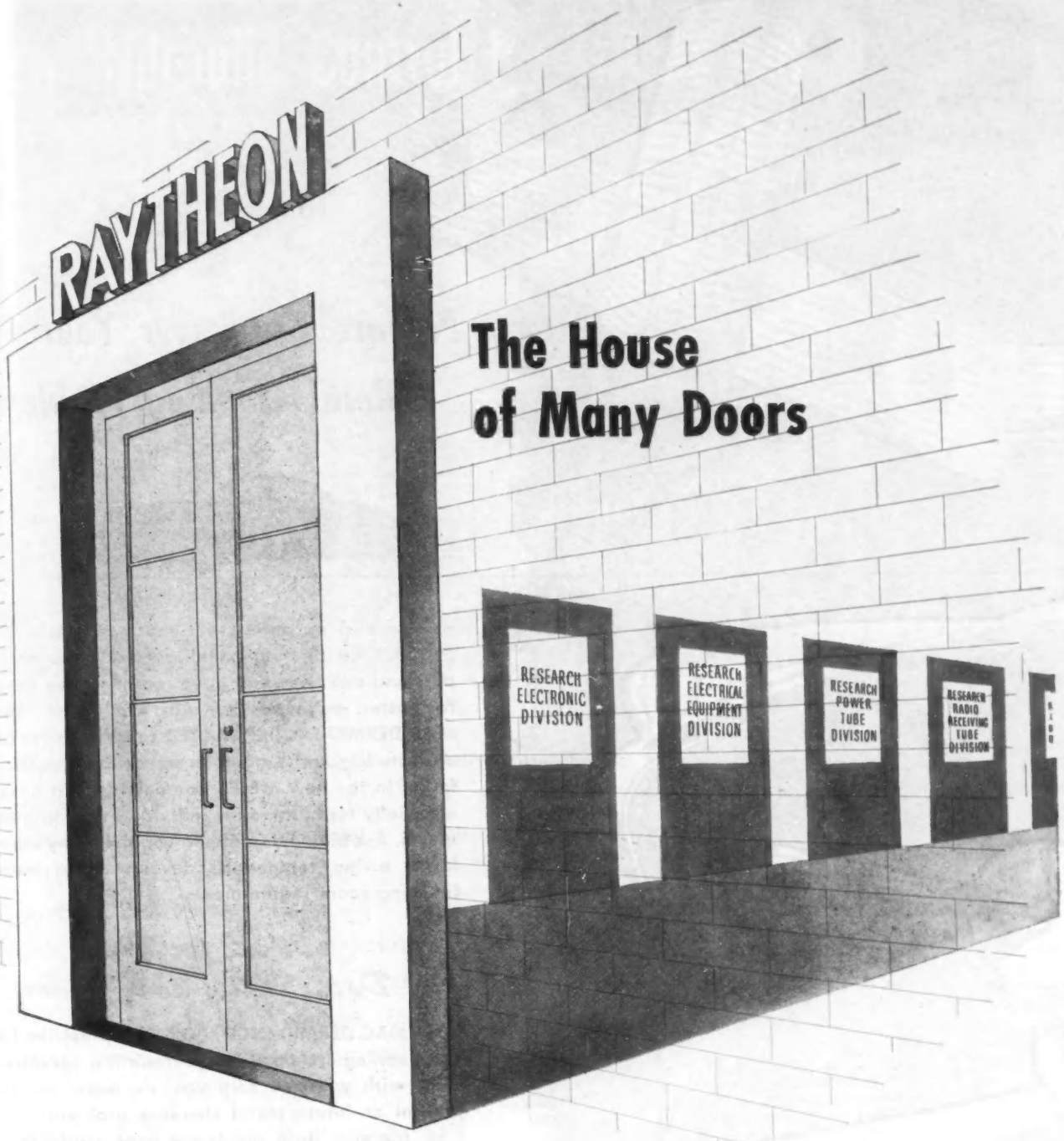
THAT WAS DESIGNED AND SERVED IN MAKING TEMPERATURE SURVEYS IN MOVING VEHICLES UNDER CONDITIONS OF VIBRATION AND EXTREME AMBIENT TEMPERATURE BEFORE THE WAR IS SERVING UNDER CONDITIONS OF GREATER VIBRATION AND MORE EXTREME AMBIENT TEMPERATURE NOW, AND WILL BE BETTER ABLE TO MEET THE NEW PEACE TIME REQUIREMENTS OF THE FUTURE.

THE LEWIS ENGINEERING CO.

Specialists in Engine Temperature Measurements

• NAUGATUCK, CONNECTICUT. •

• POTENTIOMETERS • • • • • • SELECTOR SWITCHES • • • • • • • • • THERMOCOUPLES •
• PYROMETERS • • • • • • RESISTANCE THERMOMETERS • • • PROTECTION TUBES •



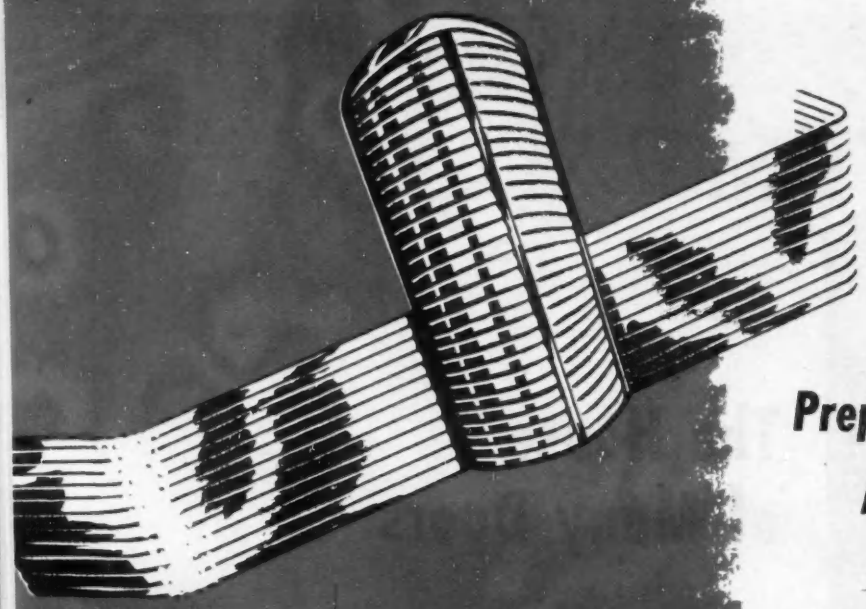
RAYTHEON is truly a house of many doors . . . doors that lead to many research, engineering, and production groups which have made great contributions to the quality and quantity of electronic equipment and receiving and transmitting tubes now helping the armed forces.

Today, behind these closed doors over 16,000 men and women are devoted to war work. Tomorrow, these doors will be wide open and through them will come new developments in all phases of electronics.

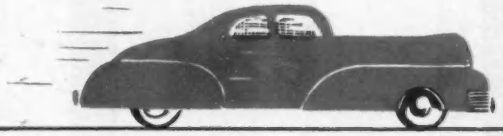
Tune in the Raytheon radio program: "MEET YOUR NAVY," every Saturday night on the Blue Network. Consult your local newspaper for time and station.

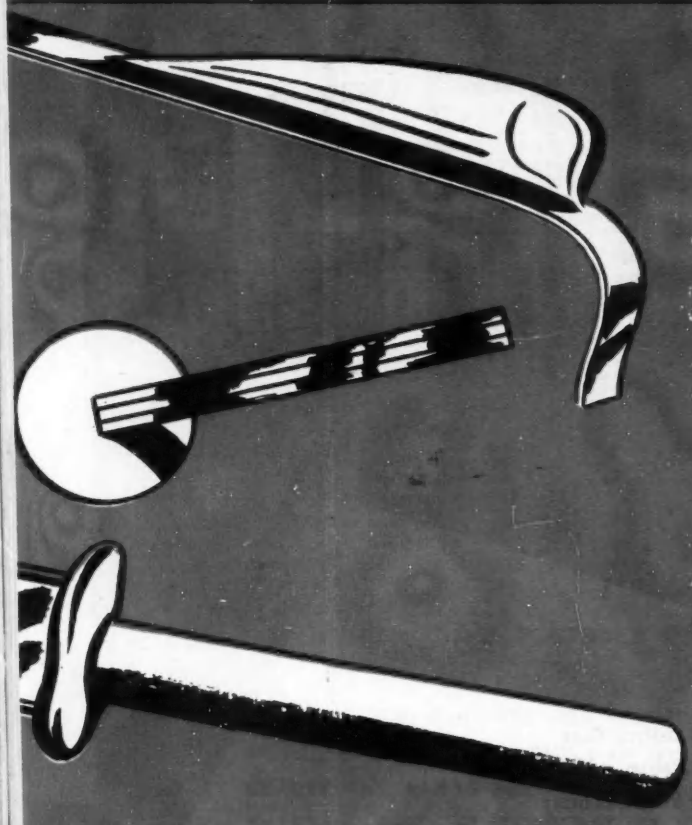
RAYTHEON MANUFACTURING COMPANY
Newton and Waltham, Massachusetts

Devoted to research and manufacture of complete electronic equipment; receiving, transmitting and hearing aid tubes; transformers; and voltage stabilizers.



Prepare Today for Your Futu
Metal Cleaning Problems





Be sure and learn about the many new MAC DERMID INCORPORATED metal cleaners, pickling agents, strip pers and additives that have recently been developed for faster, more positive war production. Ask your MAC DERMID INCORPORATED representative to dem onstrate to you the many incomparable qualities to be found in the new METEX compounds that have been especially formulated for individual cleaning require ments. Ask him to describe to you the many other new faster acting compounds developed for individual finishing room requirements.

Write for Free
Data Sheets and Folders

Have MAC DERMID INCORPORATED prescribe the cor rect cleaning cycle prior to your plating operations . . . work with you and help you, no matter what your present or future metal cleaning problems may be. Free, file size, data sheets are now available on the improved compounds recently developed. Be sure and write stating your problem.

Compounds and Equipment for Metal Finish

MAC DERMID
INCORPORATED
WATERBURY 88, CONNECTICUT

WRITE ONE OF THESE SERVICE ORGANIZATIONS FOR FREE DEMONSTRATION

NEW YORK	DETROIT	CHICAGO	CLEVELAND	ST. LOUIS	TORONTO—CA
Udylite Corp. (L. I. City)	Udylite Corp. Wagner Bros.	Udylite Corp. Geo. A. Stutz Mfg. Co.	Udylite Corp. McGean Chem. Co.	LaSalco, Incorporated	Clark Industrial Supplies Co.

New Hydraulic Control for Trucks and Busses

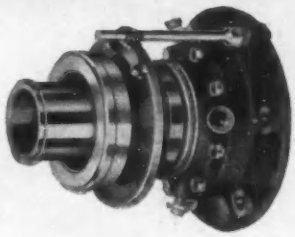
In heavy-duty operation such as illustrated, the Hydrolease will offer particularly important advantages.

Here's a remarkable new hydraulic development revolutionizing operation of clutch throw-out mechanisms in heavy-duty motor vehicles.

The PESCO *Hydrolease*, a hydraulic clutch actuator, brings the smooth, positive force of hydraulics to clutch control. It materially reduces clutch pedal load, easing operation and strain on both driver and vehicle. It makes clutch pedal action more accurate, reduces wear and maintenance on the clutch, and eliminates many mechanical parts.

The PESCO *Hydrolease* has been thoroughly tested in the laboratory and *on the road*. It's ready for specification now. Write for full details. PESCO Products Co., Automotive Division N, 11610 Euclid Ave., Cleveland 6, Ohio.

PESCO HYDROLEASE



IMPORTANT ADVANTAGES

1. New ease and smoothness in clutch operation. Clutch response is more accurate. Eliminates "creeper gear jerk".
2. Lightened clutch pedal load, approximately 50 per cent less.
3. Constantly adjusted clutch clearance between the clutch release bearing and the clutch throw-out mechanism. Saves clutch plate linings.
4. Reduced weight, reduced number of working parts, reduced maintenance cost.
5. On one typical bus installation the PESCO *Hydrolease* eliminates 42 working parts, 19 points of lubrication . . . and its cost, 60 per cent less.

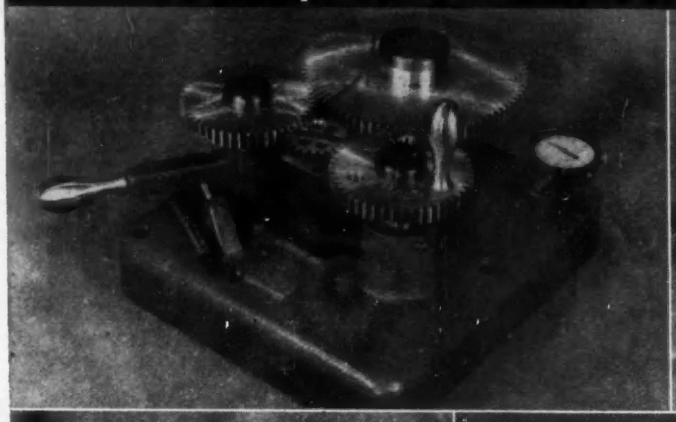
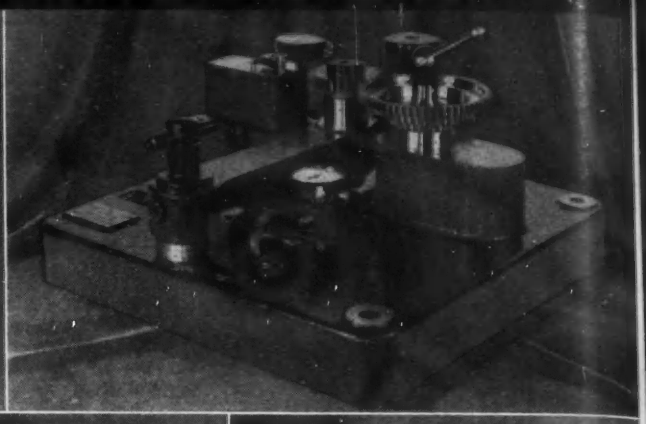
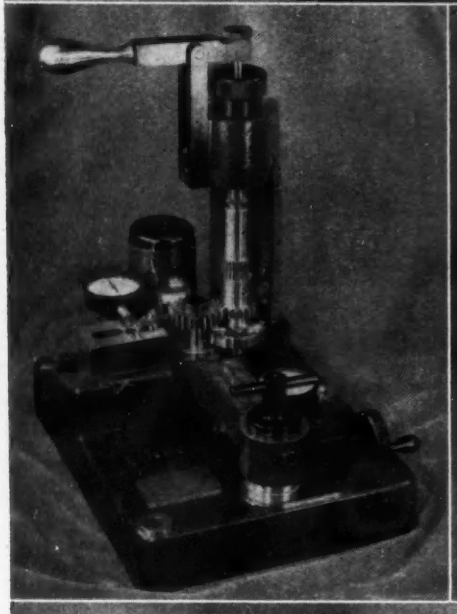
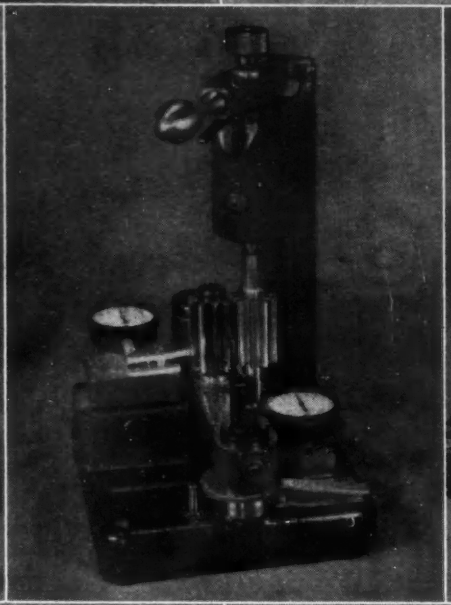
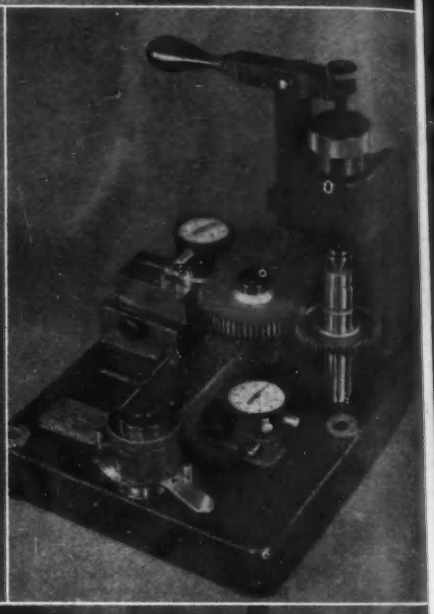
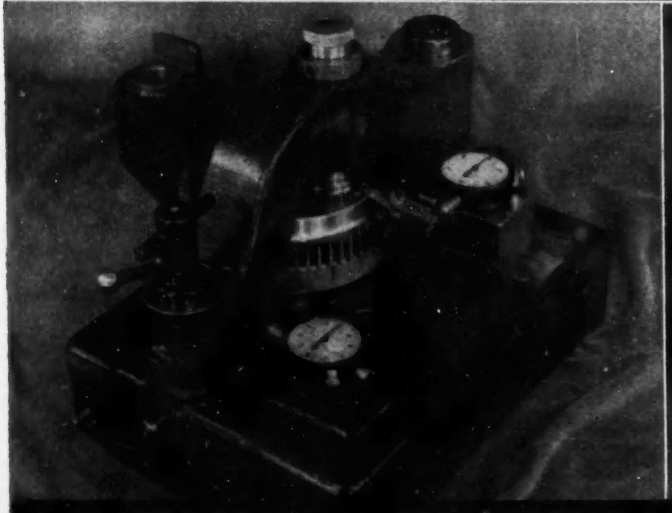
Division Borg-Warner

In Precision Hydraulics, Fuel Pumps, Air Pumps, Related Accessories . . .

PERFORMANCE POINTS TO Pesco FIRST

VINCO GEAR ROLLING FIXTURES *with* MASTER GEARS

. . . a positive check for backlash and run-out.

VINCO CORPORATION, 8871 SCHAEFER HIGHWAY, DETROIT 27, MICHIGAN, SALES OFFICES, NEW YORK, CHICAGO, CLEVELAND

MILLIONTHS OF AN INCH FOR SALE BY V I N C O

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Hub Gages • Built-up and Special Gages • Gear Rolling Fixtures • Spline and Index Fixtures • Hydraulic Power, Control, Utilization and Distribution Units • Engineering, Design and Development

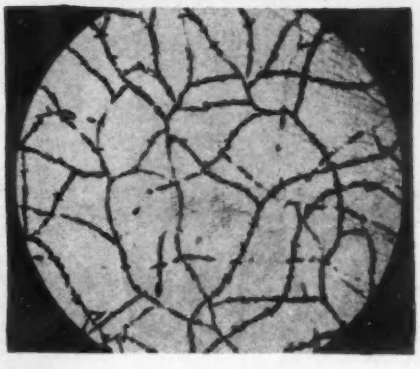
NEWS OF POROUS CHROMIUM

and the Great Job it's Doing!

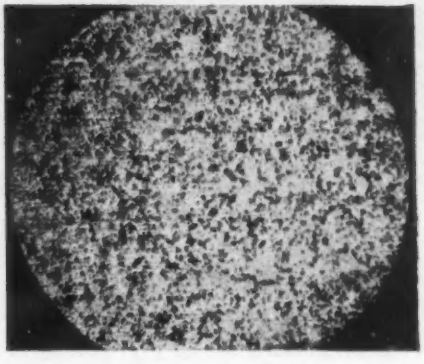
HIGHLIGHTS OF UNITED CHROMIUM'S STORY

1 Thousands of cylinders for diesel, aircraft and other internal combustion engines are being plated today by and for the U. S. Government under United Chromium license—making possible valuable improvements in functional operation, as well as greatly increased service life.

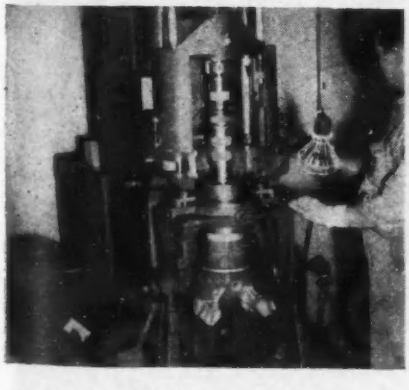
2 A vital consideration in utilizing porous chromium to best advantage is the type of porosity best suited to the part in question. United Chromium's pioneering research in all phases of chromium plating is of particular importance in determining the most satisfactory procedure at each stage of processing.



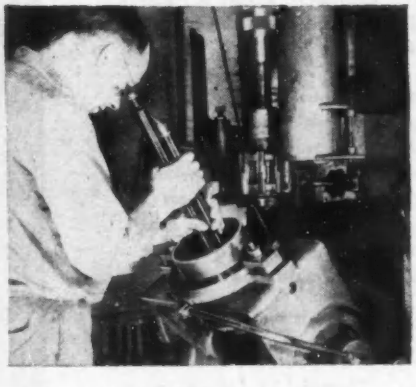
3 Deposit of the chromium plate, for example, calls for close coordination and control of the bath composition, temperature and current density. "Channel" type porosity, shown in microphotograph above, is generally specified for aircraft cylinders.



4 Type and degree of porosity is determined only after careful study of the conditions under which the part will operate—with respect to fuel, lubrication, cooling, etc. "Pitted" type porosity, shown in microphotograph above, is frequently found most desirable for diesel liners.



5 The final finishing operation is important. This usually involves honing—special attention being given to the amount of plate removed, the rate of cutting and final cleaning.



6 United Chromium assists its licensees by furnishing detailed information for each step in the procedure—from the time work is received to the final inspection.

HOW POROUS CHROMIUM IS MADE AVAILABLE

United Chromium offers engineering and technical assistance—from specifications and layouts for equipment to analysis and maintenance of solutions—which assists our licensees to put their installations into prompt and efficient production. We will gladly furnish interested manufacturers with information as to how POROUS CHROMIUM can be adapted to their needs. In writing, please give us such pertinent information as the size and number of pieces to be plated, composition of the basis metal and the service conditions to be encountered.

UNITED CHROMIUM, INCORPORATED

Waterbury 90, Conn. **51 East 42nd Street, New York 17, N. Y.** **Detroit 7, Mich.**

EVEN WIDER ACCEPTANCE AWAITS

BONDERIZED

AUTOMOTIVE PRODUCTS

More than ever, car and truck buyers are conscious of the value of Bonderizing on automotive bodies, hoods, fenders and other painted steel parts. Millions of pre-war cars and trucks have stayed longer in their owners' service and have given a practical demonstration of the extra "finish endurance" and rust prevention which Bonderizing provides.

The ever-widening use of Bonderizing for a multitude of home products in daily use—such as refrigerators, washing machines, furnace housings, air ducts, steel window frames, bicycles—and its tremendous service on military equipment have emphasized its value. Bonderizing on steel creates a surface which *bonds* the paint finish to the metal, for longer fine appearance and for preventing the spread of rust from scratch or mar. Today the public has come to expect this extra value on the automotive products it buys.

PARKER RUST PROOF COMPANY
2181 E. Milwaukee · Detroit 11, Michigan

BONDERIZING • **PARKERIZING** • **PARCO LUBRIZING**
HOLDS PAINT TO STEEL INHIBITS RUST RETARDS WEAR

PARKER PRODUCTS CONQUER RUST

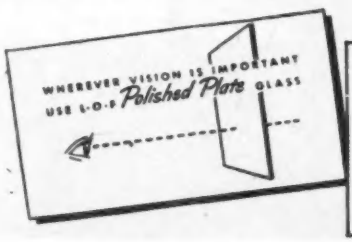
GOOD SEEING... an important element in GOOD DRIVING

You can't do anything about the eyesight that buyers of your postwar cars may have.

But you *can* make sure that nothing in your cars *impedes* their vision. Remember that drivers watch the road hour after hour through glass—and that their driving actions are governed by what they see. That's why optical distortion in glass endangers highway safety.

This points clearly to the need for providing top-quality safety plate glass in windshields and windows of your postwar cars... and to using it today for glass replacement.

Many manufacturers of America's cars have standardized on genuine L·O·F Hi-Test Safety Glass, not only for windshields, but for side windows and back windows as well. This top-quality glass consists of two panes of plate glass—carefully ground and polished for greater freedom from annoying optical distortions—bonded by a layer of tough plastic. For better visibility—use this better glass. Libbey·Owens·Ford Glass Company, 42124 Nicholas Bldg., Toledo 3, Ohio.



L O F

LIBBEY·OWENS·FORD

a Great Name in **GLASS**

Engineering
Forty-one years' specialization has given the Long organization an unusual background of experience in heat exchange unit engineering and manufacture. War accelerated new developments, many new applications, and added substantially to our knowledge of the field. This engineering and manufacturing experience will be turned back to peacetime production when peace comes.
LONG MANUFACTURING DIVISION
BORG-WARNER CORPORATION
DETROIT 12, MICHIGAN • WINDSOR, ONTARIO
ARMY
NAVY
LONG
CLUTCHES • RADIATORS • OIL COOLERS

Upsetting gets work under way fast

In two quick steps, this little part is made. The head and the shank with projection are upset from Alcoa Aluminum wire in a rivet header. A blanking operation shapes the head, and the part is ready for heat treating.

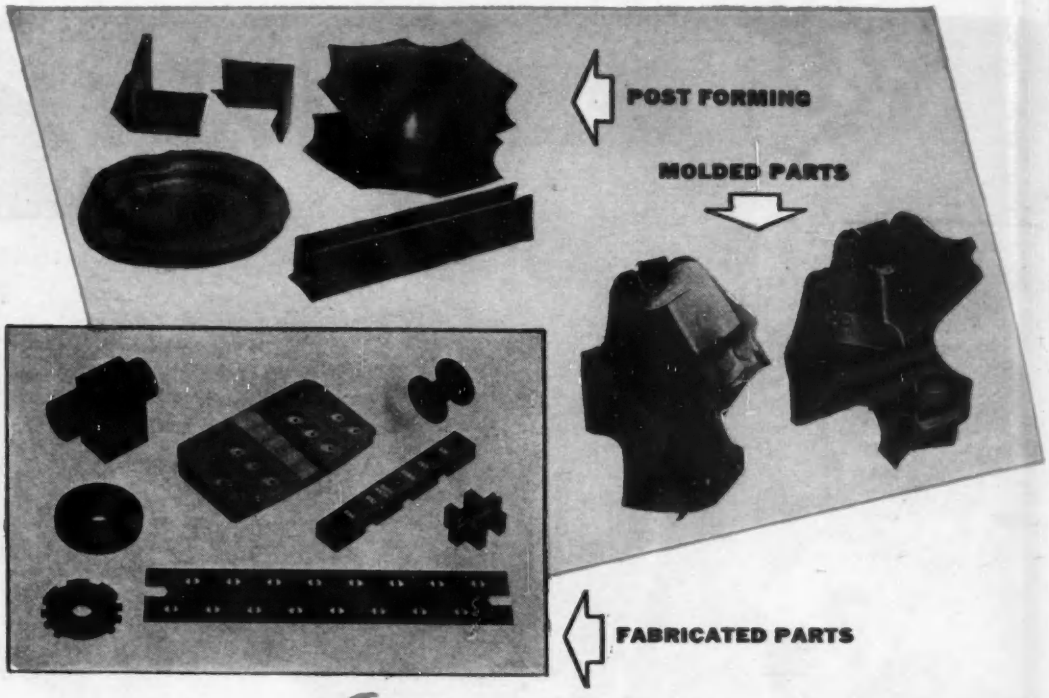
Dimensions can be closely controlled in these heading and blanking operations. Parts, like the carriage bolts you see in the photograph, can be produced with well filled-out square shoulders without the need of expensive milling operations.

Where design and quantities warrant production by upsetting, this process develops sizable economies. In addition to being fast, it saves raw material. You use all the metal you start with, obtaining final shapes by upsetting.

Alcoa is equipped to supply you with aluminum parts produced either on rivet headers, on automatic screw machines or a combination of both. Recommendations are based, therefore, on the most economical method. ALUMINUM COMPANY OF AMERICA, 2181 Gulf Bldg., Pittsburgh 19, Pennsylvania.

ALCOA ALCOA ALUMINUM REG. U.S. PAT. OFF. **ALUMINUM**

COMPREG



FABRICATED PARTS

Come to PANELYTE* for { DIRECT, TIME-SAVING ANSWERS TO ALL QUESTIONS ON MOLDED AND FABRICATED THERMO-SETTING PLASTIC PARTS

The nationwide organization of the Panelyte Division is a clearing house for authentic, up-to-the-minute information on structural laminated resinous plastics.

Our replies to your inquiries are founded — not on theory — but on basic experience in the mass production of fabricated and molded thermo-setting plastic parts for all branches of industry. Nor is this technical help limited to knowledge gained within our plant. Our policy of working closely with customers' engineering departments enables us to give designing aid — and from performance data on hand, to make accurate estimates on the service life of proposed plastic applications.

New type plastics and improved molding and fabrication techniques, developed by our engineering staff, increase efficiency and cut costs on widely divergent applications.

We are always glad to answer *any* question regarding the design, production cost or use of molded and fabricated laminated plastic parts.

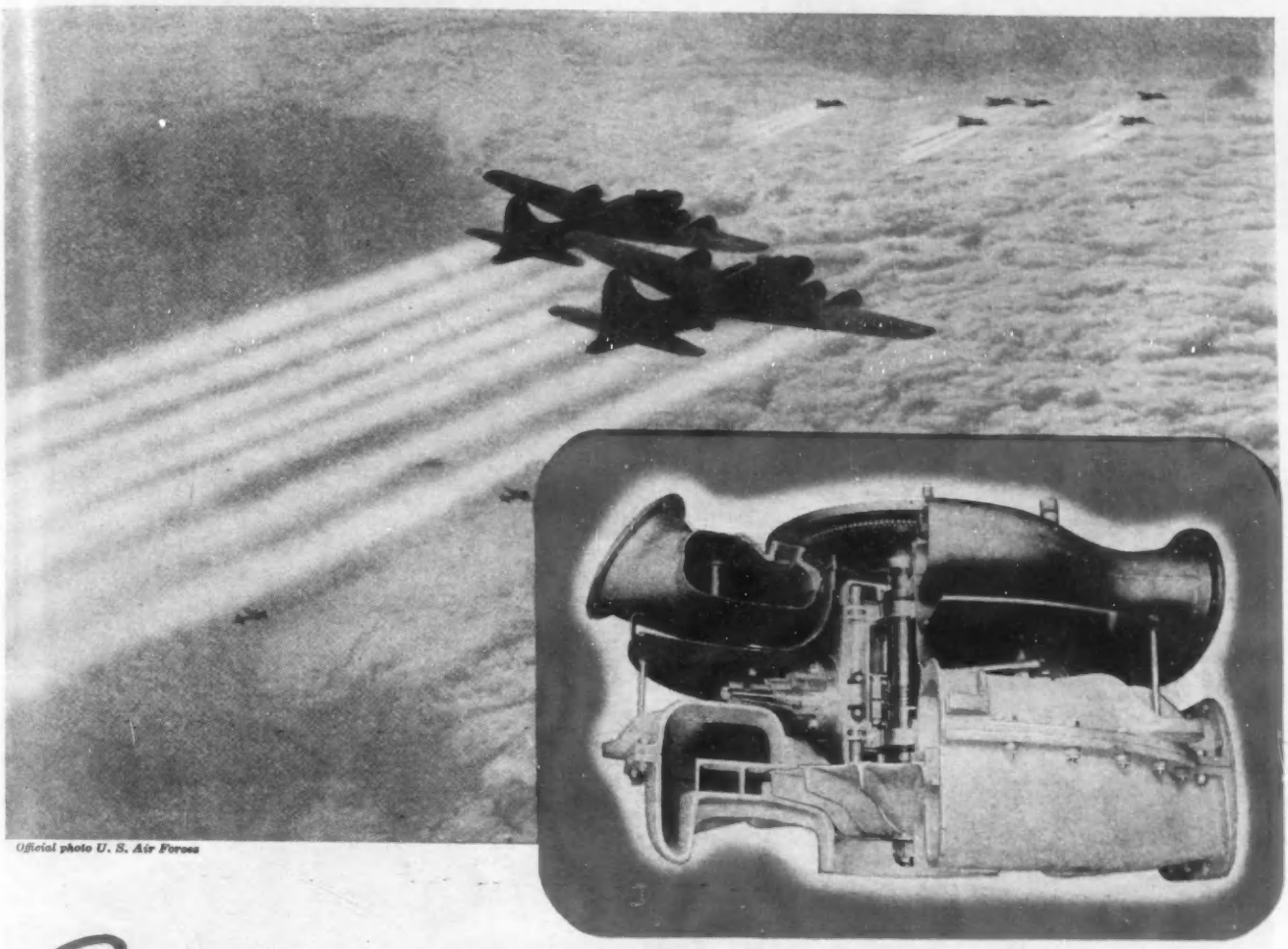
Write for factual "Data Book"

PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Montreal, New Orleans, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver

* MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS



Official photo U. S. Air Forces

Breathing Fire at 65 below Zero

At eight miles up, where the air is too thin to sustain combustion, it must be compressed and crammed down the airplane engine's windpipe. That's the job of the ingenious device shown above—the turbosupercharger.

One half is a rotary compressor—the other half a gas turbine, driven at some 30,000 r.p.m. by the flaming exhaust gas from the engine.

Simple? How about severe thermal stresses created by hot gas at 1500° expanding the metal from the inside and frigid air at 65 below zero contracting from the outside? What of tons of centrifugal force trying to pull the rotor apart—to say nothing of corrosion and the scouring action of the rushing gas?

No wonder that Republic Electric Furnace Steel is used for the shaft—and in stainless grade for the turbine housing and rotor wheel. The tiny turbine blades welded to the rotor wheel are electric furnace steel, too.

It's in difficult uses like this that Republic Electric Furnace Steels demonstrate their ability to hit narrowest specification marks for physical, chemical, hardenability and performance values through "targeting" possible only in electric furnace melting.

It's in such vital applications that the slight extra cost of Republic Electric Furnace Steels is cheap protection against hidden imperfections—insurance against premature, dangerous and costly failure.

Republic—world leader in electric furnace steel-making—is ready to tell you how these same steels can help YOU achieve top quality in YOUR peacetime products—how their consistent uniformity, cleanliness and soundness will enable you to obtain maximum results from mass production methods. Write us.

REPUBLIC STEEL CORPORATION

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REPUBLIC

—Leader in the Production of

ELECTRIC FURNACE STEELS

"QUALITY" steels . . . alloy . . . stainless

OVER THE HUMP

High over the "hump," the Air Transport Command delivers another one. Rangoon, Moscow, Burma or Bermuda—names on a map are just stopping-off points for the shuttle shift. Flying the "roof route" or skimming the white-tops, the Air Transport Command is doing noble work, unsung in headline or on loudspeaker. Thousands of planes every month are being delivered safely from factory to fighting line, ready for action.

Air Transport Command pilots, like combat pilots, have confidence in the Delco motors that actuate their fuel pumps, air pumps, windshield wipers, defroster fans and machine gun mounts. They know that Delco motors were designed and built to stand the gaff.

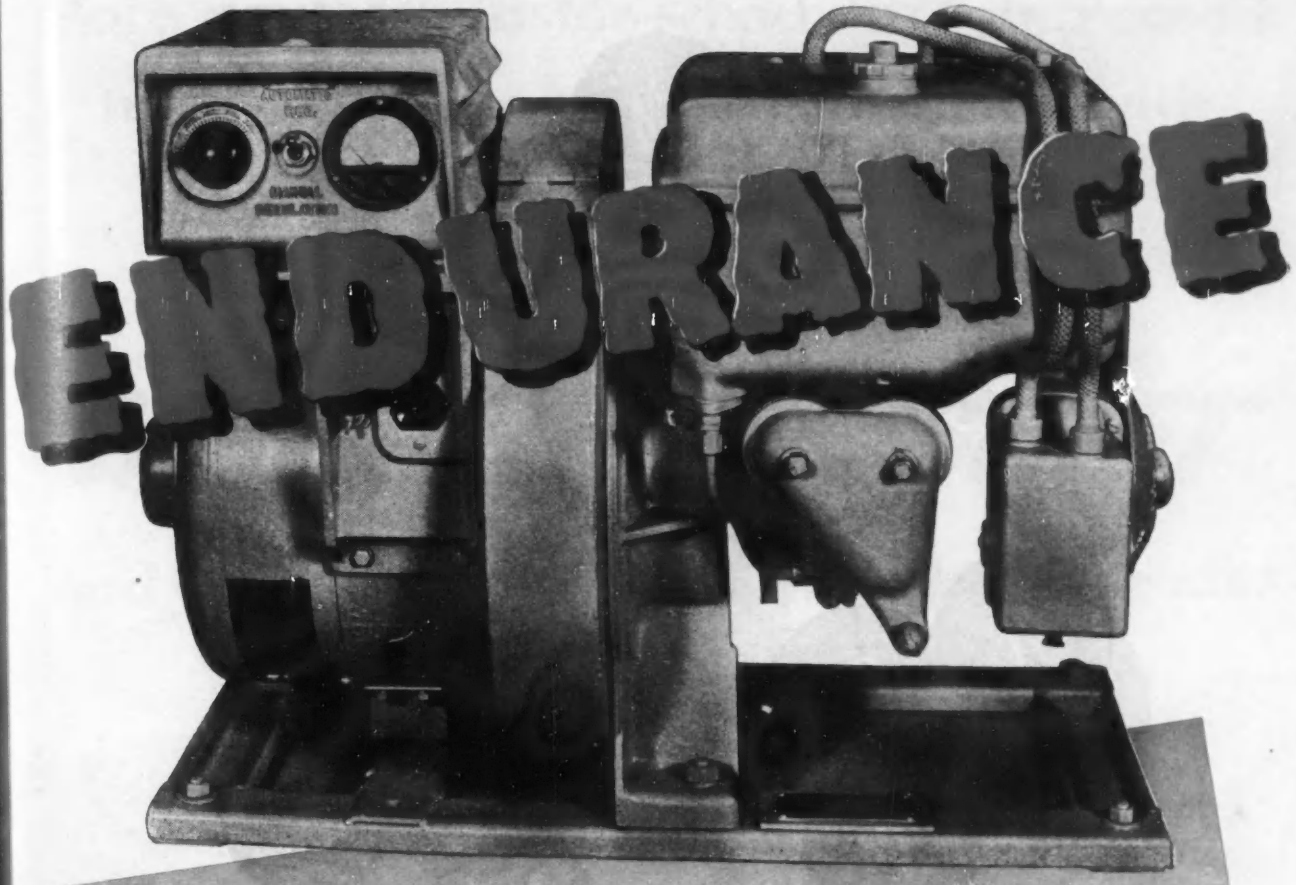
When it comes to "fractional h.p.," Delco Products' years of engineering and manufacturing experience are the choice of leading aircraft producers everywhere. They know they can depend on Delco.

The War Isn't Won Yet

BUY MORE BONDS

DELCO MOTORS

DELCO PRODUCTS *DIVISION OF* **GENERAL MOTORS**



• In warfare, both men and machines are called upon to meet stupendous endurance tests. Kiekhaefer-built Mercury Two-Cycle, Air-Cooled Engines were among the first special engines to reach the fighting fronts. They have made exceptional records for dependability, endurance, and trouble-free service in many unusual applications.

The ability of Mercury Engines to deliver MOST POWER PER POUND OF WEIGHT makes them particularly suited to compact, portable equipment such as the generator set pictured here. A feature of vital importance is the special Kiekhaefer Governor...providing positive speed control under all varying load conditions.

Where the foot soldier carries his own equipment, in airplanes where the saving of weight is a critical factor, on equipment that must go into inaccessible places, Kiekhaefer Mercury Engines meet the challenge.

LET KIEKHAEFER POWER YOUR POSTWAR PRODUCT

If you have developed or are developing a product that requires lightweight, flexible power, Kiekhaefer may be able to supply or develop the exact engine to meet your needs.

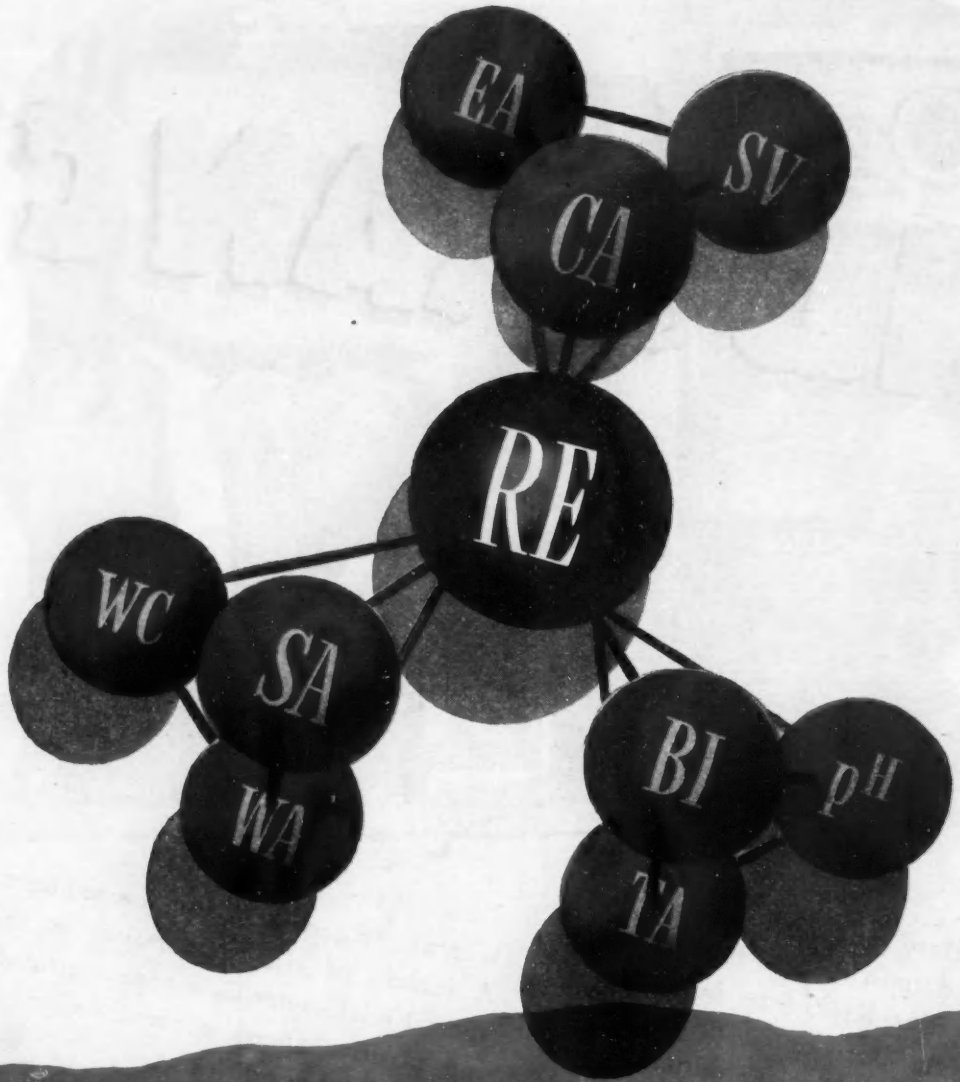
Write for Free Bulletin 603.

STAY IN THE FIGHT — BUY ANOTHER WAR BOND TODAY — 6 WAR LOAN

KIEKHAEFER CORPORATION

CEDARBURG • WISCONSIN

MERCURY INDUSTRIAL ENGINES — MERCURY OUTBOARD MOTORS . . . *built to use — built to last*



THIS IS WHAT HAPPENS WHEN YOU BATHE METAL

Correctly cleaning metal is no simple operation... these elements must go into action...

Wetting Action *(WA)* must lower surface and interfacial tensions and allow the cleaning solution to penetrate to surface of the base. Emulsifying Action *(EA)* must disperse grease and oil as tiny globules, and by suspension prevent redeposition. Saponifying Value *(SV)* must convert organic fats and oils into soluble soaps, and Solvent Action *(SA)* put soils into solution. Colloidal Activity *(CA)* must disperse solid soils into minute particles which may then be easily removed. Water Conditioning *(WC)* removes or controls the elements which cause water hardness.

Correct Buffer Index *(BI)* assures ability to absorb either alkaline or acid soil, thus prolonging efficiency of the solution. Proper *pH* assures the correct measure of energy of alkalinity and Total Alkalinity *(TA)* must supply maximum active cleaning energy.

In formulating a cleaning compound, therefore, it is obvious that no one factor is a magic key to all problems. The answer is in determining the relative value of *all* these factors as they apply to your problem.

Putting these factors into correct balance is a responsibility you can entrust to Turco chemists —a responsibility for which their two decades of Research and Experience *(RE)* have well qualified them. Take your problem to Turco.

For a fuller explanation of these vital factors, write for Turco's Booklet on your firm letterhead, please.

TURCO

INDUSTRIAL CHEMICAL COMPOUNDS

TURCO PRODUCTS, INC. *Main Office and Factory:* 6135 S. Central Ave., Los Angeles 1, Calif. • *Southern Factory:* 1606 Henderson St., Houston 1, Texas • *Chicago Office and Factory:* 125 West 46th Street, Chicago 9 • *Offices and Warehouses in All Principal Cities*

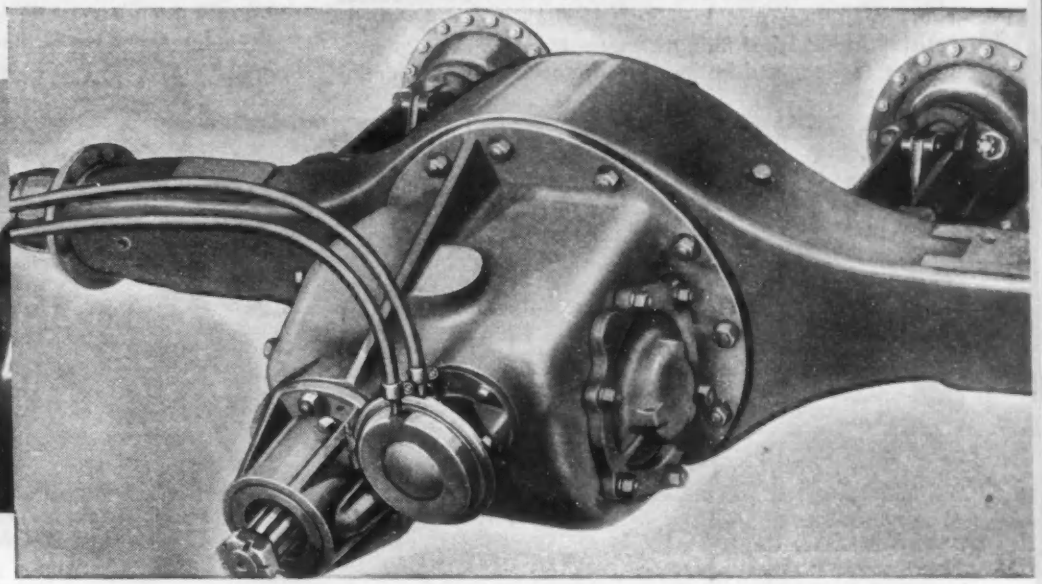
More power ★ Faster schedules ★ Increased truck earnings ★ Easier driving with

TIMKEN

EASY POWER SHIFT

and Timken 2-speed double reduction axles

Dash selector permits pre-selection of fast or slow axle ratio. Axle gears are power-shifted when accelerator is released momentarily.



Vacuum power chamber built into the axle furnishes power for shifting axle gears. All working parts are enclosed.

Capacity loads, fast schedules, more trips per day, longer hours on the road, are essential to meet today's highway transport demands. Only trucks geared for both power and speed can hope to meet these demands successfully.

Timken's new Easy POWER Shift, available only with new Timken 2-Speed Double Reduction Axles, provide the ideal combination of power and speed for modern heavy duty highway transport.

Easy POWER Shifting enables the driver to change axle ratios instantly, under any driving conditions, merely by using the Dash Selector and releasing the foot throttle momentarily. Declutching is not necessary. Combined axle and transmission shifts, or gear splits, can be made as easily and in the same time as transmission shifts alone.

By doubling the number of transmission ratios, with any gear combination instantly available, Easy POWER Shifting greatly increases truck performance — provides more pulling power, speeds up schedules, reduces operating and maintenance costs, increases earnings per ton-mile, and reduces driver fatigue.

Write for descriptive folder.

38 YEARS OF AXLE ENGINEERING LEADERSHIP

TIMKEN AXLES The Accepted Standard D A CO

TIMKEN AXLES

THE TIMKEN-DETROIT AXLE CO., DETROIT 32, MICHIGAN

WISCONSIN AXLE DIVISION, OSHKOSH, WISCONSIN

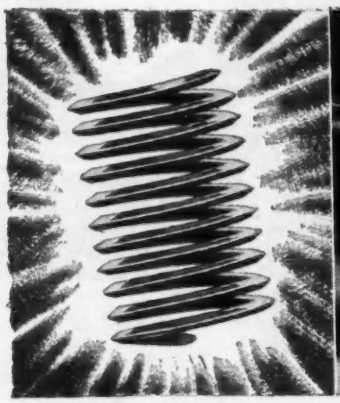
HOW "Heli-Coil" INSERTS REDUCE HOURS TO MINUTES

In the shops of American Export Airlines, Inc., replacement of burned or worn-out spark plug bushings formerly required removal of the cylinder from the engine. This took several hours—often most of a day. Today, "Heli-Coil" Inserts restore the bushings to perfect condition in less than an hour—*without removing the cylinder*. They are easily installed—using only simple hand tools in maintenance operations (see photographs below).

"Heli-Coil" inserts are also used in original installations as spark plug and stud bushings, providing a tight wear-resistant, leak-proof fitting. They will not corrode in storage or service, and in the case of spark plugs, eliminate freezing and insulation, permitting removal of spark plug with same torque as used for installation. For assembly on a production basis, power tools are available.

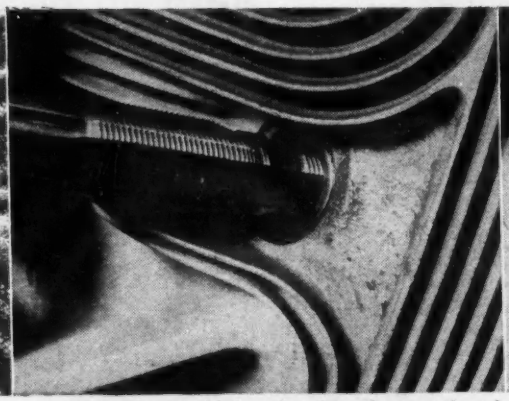
"Heli-Coil" Inserts are precision-shaped stainless steel helical coil thread-liners. They engage the retapped thread of the spark plug bushing, or any American National tapped thread providing a permanent, hard, smooth surface. They are about one-fifth the weight of solid bushings and occupy less than half as much cross sectional area, permitting more latitude in design and greater strength. Send for further information.

THE SCREW SYSTEM WITH THE ANTI-FRICTION THREAD LINING



U. S. and Foreign Patents Issued and Pending

INSERTING tool is placed over the tapped hole and Insert wound through threaded sleeve into hole.

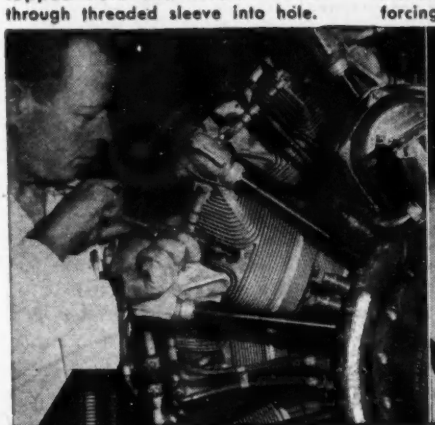


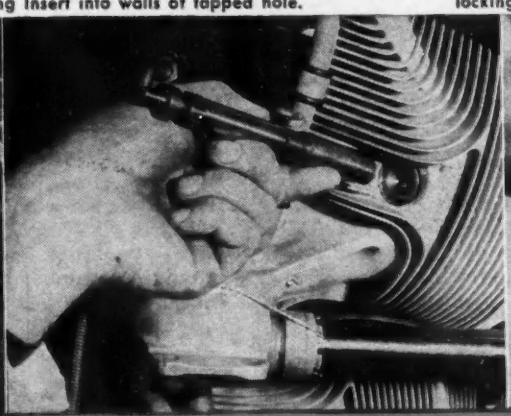
REAMING out old thread and tapping new thread for the "Heli-Coil" Insert, in one operation in shops of American Export Airlines, Inc.

EXPANDING tool ready to be screwed into Insert. Mandrel will then be pushed down into sleeve, forcing Insert into walls of tapped hole.

CLOSE-UP of inserting tool, comprising mandrel and threaded sleeve, with Insert in sleeve.

STAKING sleeve is placed over expanding mandrel until sleeve meets boss. Light blow on top of sleeve knurls chamfered edge around hole, locking Insert into walls of tapped hole.





HELI COIL

AIRCRAFT SCREW PRODUCTS COMPANY, INC.

47-23 35th STREET • LONG ISLAND CITY, 1, N.Y.

Design value

goes beyond

price

What does one designer build into his product that makes it sell at a profitable price, while a competing article loses money for its producer?

Little things, often hidden things. Little things that make a big difference, like Lord Shear Type Mountings or Bonded Rubber.

Where there is machinery in motion, there is vibration, and vibration means strain to machine and to man. Lord Shear Type Mountings and other bonded rubber products control and isolate vibration.

Factories that are quieter, pleasanter, more efficient; automobiles, trucks, buses, locomotives, airplanes that are smoother and safer in operation; delicate laboratory equipment that is made more accurate and trust-worthy; these are the results that Lord is helping designers and manufacturers to accomplish.

The science of vibration control and isolation has been developed by Lord for more than twenty years. This accumulated experience is available to you, without cost, whenever you are faced with a vibration problem.

Write for free literature which will bring you up to date in factual information on vibration control. Lord Vibration Engineers will work with you to bring your product to a new standard of perfection.

LORD
BONDED RUBBER
Shear Type
MOUNTINGS

Buy More War Bonds

IT TAKES RUBBER *In Shear* TO ABSORB VIBRATION

LORD MANUFACTURING COMPANY
ERIE, PENNSYLVANIA

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BURBANK, CAL. - 245 E. OLIVE AVE.
CANADIAN REPRESENTATIVES
RAILWAY & POWER ENGINEERING CORP., LTD.
TORONTO, CANADA

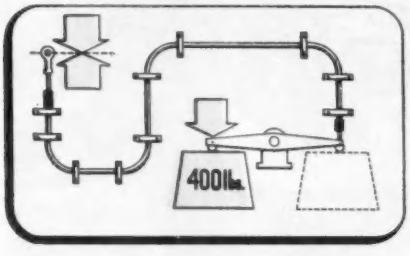
Originators of Shear Type Bonded Rubber Mountings

Dependable *all around duty assured with* Simmonds Push-Pull Controls

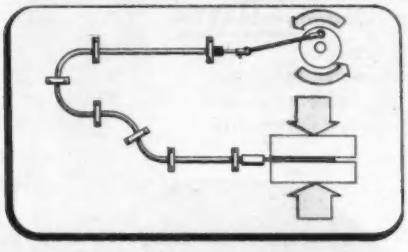
Read how these other tests, conducted to AAF specifications, show how Simmonds products more than qualify for EXTRA DUTY as well as NORMAL DUTY operations.

FIRST TO CARRY THE YELLOW DOT

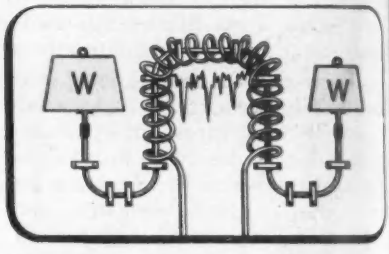
of Army Air Force Winterization acceptance for operation in extreme temperatures is the Simmonds-Corsey Push-Pull Control. Comprehensive tests with temperatures as low as minus 72°F. and as high as 160°F. prove efficient operation under wide variety of conditions.



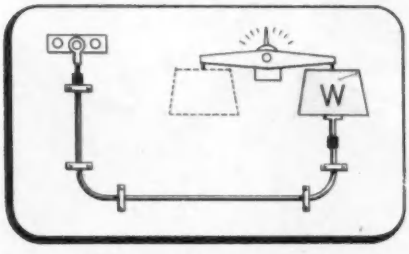
STATIC STRENGTH: *In this test Simmonds push-pull control successfully withstands tensile and compressive forces of 400 lbs. Credit simplification of design, improved linkage.*



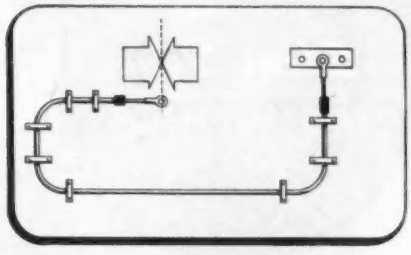
ENDURANCE: *Cycled 30,000 times under stress, as illustrated, Simmonds controls are not affected in any way, and can be expected to outlast the life of unit served.*



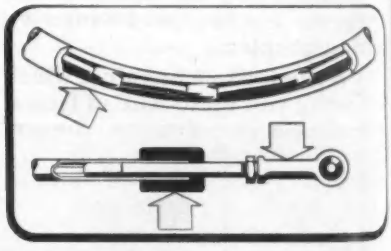
EFFICIENCY: *Input-output ratio of control is measured at various temperatures in insulated chamber. Result: average efficiencies are twice the AAF requirements.*



PRECISION CONTROL: *Motion between tension and compression is negligible. Before endurance test: average—.046"; after—.082". Simmonds are precision-built controls.*



DEFORMATION: *AAF specifications call for loads ranging from 10 to 50 lbs. Allowable average deformation is .140". Simmonds controls average only .083".*



CORROSION: *Simmonds controls meet AAF specifications for corrosion resistance with standard cadmium plated or anodized surfaces. Tube ends are rubber sealed.*

INQUIRIES concerning War Contracts or Post-War problems involving push-pull control equipment are invited. Our service engineers will furnish you gladly with analyses and recommendations. Telephone or write to your nearest Simmonds office.

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Automatic Engine Controls — Push-Pull Controls — Spark Plugs
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Can You SEE the DIFFERENCE in these Gears?

Of course you can't see the difference—but it's there. One gear has been *shot-peened* and the other hasn't.

The shot-peening operation is just one of the added values that mark the Fuller Transmissions which will be available for your peace-time operations. The full explanation is too long and technical to be repeated here, but it is a method of treating gears (or any metal parts subject to stress) by "pre-loading" the surface to prolong life and delay what is commonly called fatigue failure.

Fuller was the first manufacturer of heavy duty truck transmissions to adopt this relatively new process. Gears so treated have been running in Fuller Transmissions for a considerable time, and the results have been uniformly successful.

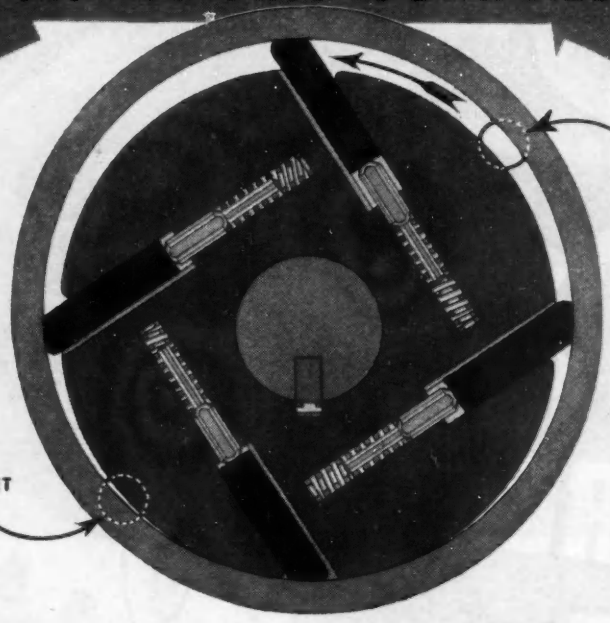
The Fuller Transmissions of Tomorrow will be better than ever. And that—in view of Fuller performance during the trying war years—is saying a lot.

Fuller TRANSMISSIONS

FULLER MANUFACTURING COMPANY, KALAMAZOO, MICHIGAN
Transmission Division
Unit Drop Forge Division, Milwaukee, Wisconsin

WAGNER AIR BRAKES

The Only Air Braking System with the ROTARY COMPRESSOR



That's Why They Are FIRST in Economy and Reliability

The Wagner Rotary Air Compressor used in Wagner Air-Brake Systems is one of the outstanding developments achieved in the field of automotive air-brake equipment. This revolutionary type of air compressor utilizes the rotary principle to compress the air needed in the air-brake system, and its high efficiency is largely responsible for the absolute dependability of Wagner Air Brakes.

POINTS OF EXCELLENCE OF THE WAGNER ROTARY COMPRESSOR

1. Rotary Motion.
2. Perfect running balance at all times.
3. Longer belt life due to more uniform torque loading.
4. Low friction losses—therefore high operating efficiency.
5. A predetermined air pressure automatically maintained.
6. Operating parts are long-lived; consequently long life and low maintenance cost.
7. Extremely quiet in operation.
8. Self-contained oiling system—consumes a minimum of oil.
9. Compact—requires minimum installation space.
10. Low operating temperature prevents carbon formation in the compressor and delivery lines.
11. Wagner Air Brakes are adaptable to *all* types of automotive brake systems.

Thousands of Wagner Air Brakes are giving outstanding service on trucks, tractors, trailers, and buses—and are establishing enviable performance records. You, too, can lower brake maintenance and increase the brake efficiency of your vehicles by installing Wagner Air Brakes. Wagner is a national organization and can render field engineering service from any one of its 25 branches located in principal cities.

K44-5

Write for Bulletin **KU-50** *for Full Information*

The System With The Rotary Compressor

ARMY E NAVY NATIONAL SECURITY AWARD

Wagner Electric Corporation

ESTABLISHED 1891

6378 Plymouth Avenue, St. Louis 14, Mo., U. S. A.

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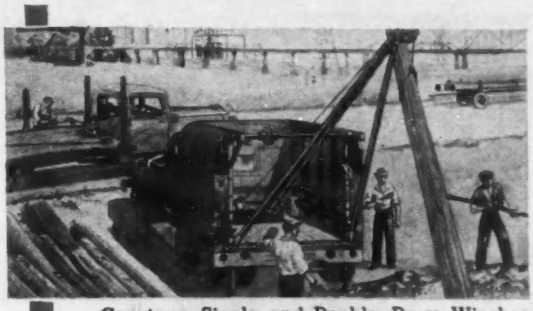

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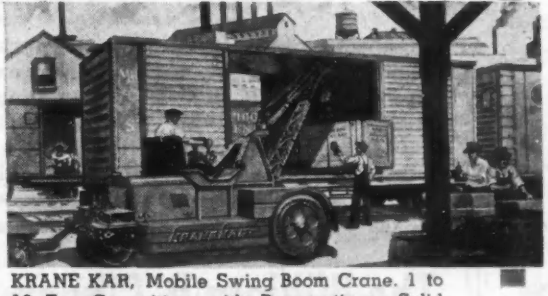
Swing Boom Cranes, Power-Operated from Truck Engine, 1 to 10 Ton Capacities, for All Makes of Motor Trucks.

Capstan and Drum Winch Car Pullers, for Pulling from 1 to 20 loaded cars.



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Capstans
Winches
Pole Derricks
Cranes

KRANE KAR

The ORIGINAL
FRONT-WHEEL-DRIVE CRANE
with TRACTION UNDER THE LOAD

Ideal for Loading and Unloading Shipments by Motor Truck or RR and for handling Air Cargo.

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EVERY HEADLINE PULLS IT CLOSER TO REALITY—a world that will benefit from the brilliant inventive triumphs of war production; truly an Anti-Friction World. We know . . . for Aetna is helping to plan and achieve it.

Scores of new products, hundreds of old products redesigned, will operate more smoothly, more economically—countless war-worn plants will be revamped, rejuvenated: all by judicious application of anti-friction bearings.

Have you made sure that your product and your plant will be ready for tomorrow's competition?

Aetna can help you. Time used for laying solid foundations of your future business is time well invested. A line or call to us makes the contact. Aetna Ball Bearing Manufacturing Company, 4600 Schubert Avenue, Chicago, Illinois.

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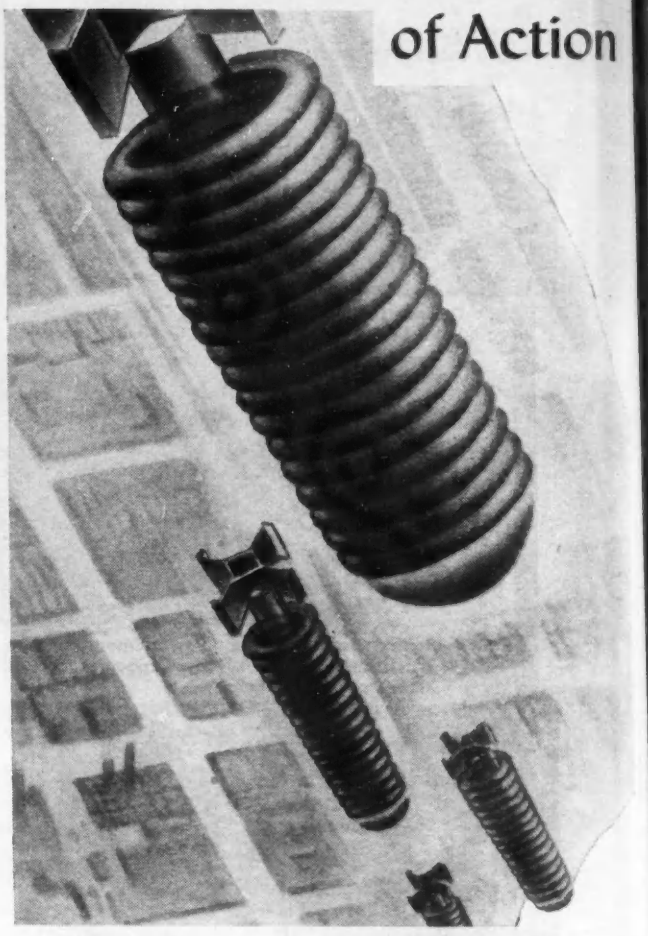
Aetna BALL BEARINGS

Long Hours of Work for a Brief Moment of Action



COMBINED efforts of inventor, metallurgist, chemist and machinist go into one swift, deadly descent of a bomb. For that all-important moment of impact, men have worked carefully and long. Springs, too, go along on the trip, waiting for the exact interval to accomplish their work. Springs must not fail in the important jobs of war. Whether their life span is brief—or enduring, there is only one standard for their manufacture—the best. These same standards will provide Gibson Springs, when great mechanical developments are released for the years of eventual reconstruction and development.

The William D. Gibson Company

DIVISION OF ASSOCIATED SPRING CORPORATION

1800 Clybourn Ave., Chicago 14, Illinois

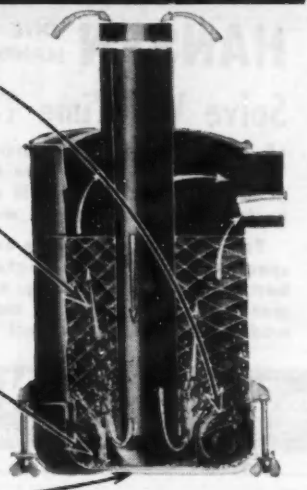
The DONALDSON *Oil-Washed* AIR CLEANER HAS NO RIVAL IN EASE of MAINTENANCE

Double Scrubbing Action. The Donaldson Oil-Washed Air Cleaner scrubs its own element as it scrubs the air . . completely self washing.

Element cannot clog. Lead coated screen element functions as a condenser . . . not as a filter. Handles heavy dirt loads without plugging. Air restriction is low and constant.

Quiet-Zone Dirt Separation. Dust, after impingement is washed down out of element into quiet zone of oil cup where it settles out. Only cleanest oil is used in scrubbing.

Simple to Service. Just remove oil cup at regular intervals, empty, refill and replace. That is all that is necessary.



Can be fitted with Collector Pre-Cleaner to increase the time between service periods

Any cleaner is only as effective as its maintenance. The Donaldson Air Cleaner is easier to service and therefore is serviced as it should be. Just one simple operation is all that's required. At regular intervals depending on dust conditions . . . remove oil cup, empty, refill, and replace! No cleaning of the element necessary . . . no trouble with clogged filters because there are none.

A Donaldson engineered installation means the air cleaner is instantly and easily accessible, encouraging the operator to stick to a servicing schedule.

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Air Cleaner Engineering Service Available to You. Write Us.

DONALDSON *Oil-Washed* AIR CLEANERS

TESTS REVEAL A REMARKABLE SEAL

A series of flight tests were recently made with engines equipped with Simplex All-Metal Oil Seal installations on high speed generator shafts operating at from eight to ten thousand R.P.M.

At the first overhaul period, after five hundred hours of field operation, examination showed wear on the seals to be extremely low, establishing a minimum life-expectancy of at least five thousand hours.

This would indicate that no removal of the seal would be necessary during the life of the engine.

Comparable results have also been attained in numerous Simplex Seal installations on shafts operating at speeds of from twenty-five to fifty thousand R.P.M.

Post-war will bring innumerable problems of sealing hydraulic transmissions at extremely high speeds. When such a problem arises in your plant, consult Simplex engineers—no obligation.

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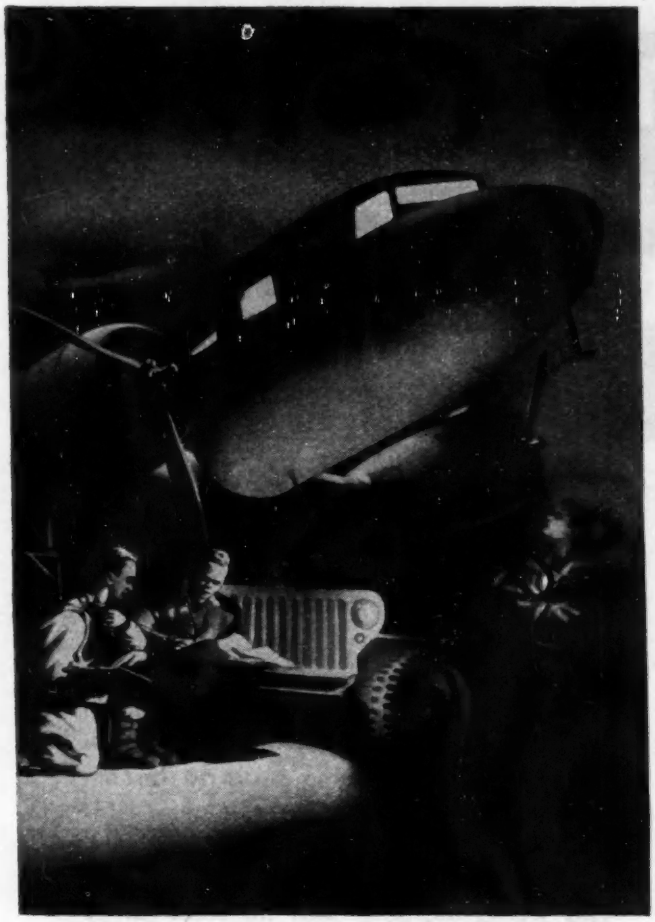
3820 KELLEY AVENUE CLEVELAND, OHIO
Manufacturers of SIMPLEX "Flying Piston" Rings

SIMPLEX ALL METAL OIL SEALS



light TO DRIVE BY
light TO FLY BY

Sixty million lamps must be right. When a company starts by manufacturing a few thousand lamps and year by year, increases production to meet demands for over sixty million lamps annually, the lamps they make must be good. That's TUNG-SOL's history. Today, you find TUNG-SOL Lamps giving satisfactory performance in cars, in trucks, in tanks and in planes throughout the world. When you specify TUNG-SOL Lamps you are ordering lamps of proven quality.

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AIRCRAFT LAMPS

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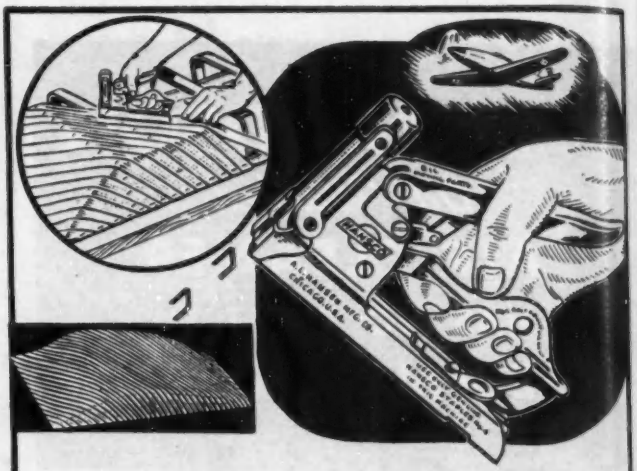
ALSO MANUFACTURERS OF ELECTRONIC TUBES AND CURRENT INTERMITTORS



HANSEN ONE-HAND TACKERS
Solve War-Time Tacking Problems

IF you have a tacking, fastening, gluing or assembly problem, it will pay you to use the HANSEN one-hand Automatic Tacker. It speeds up output, lowers costs and saves essential materials.

Tacking plywood in the construction of airplanes, speedboats, refueling boats; insulating plants and barracks; air conditioning; crating and carding shipments—are but a few of many jobs done faster the modern Hansen way. What is your problem?

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Built to blast their way over shell torn hills and through reef rimmed seas, Buffalo tractors have inspired surer footed designs for post war tractors. And the rugged service demanded of the clutches in these pitching, plunging Buffaloes has developed battle - proved types of clutches that will make peacetime tractors better able to overcome the toughest going.

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POWER TAKE-OFFS

SEND FOR THIS HANDY BULLETIN ON POWER TRANSMISSON

It shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications. Every production engineer will find help in this handy bulletin, when planning postwar products.

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With at least five years practical experience on body or chassis design and layout work. Must have college education or equivalent. Position permanent with well-established mid-west company in automotive field. Applicant must be capable of assuming responsibility.

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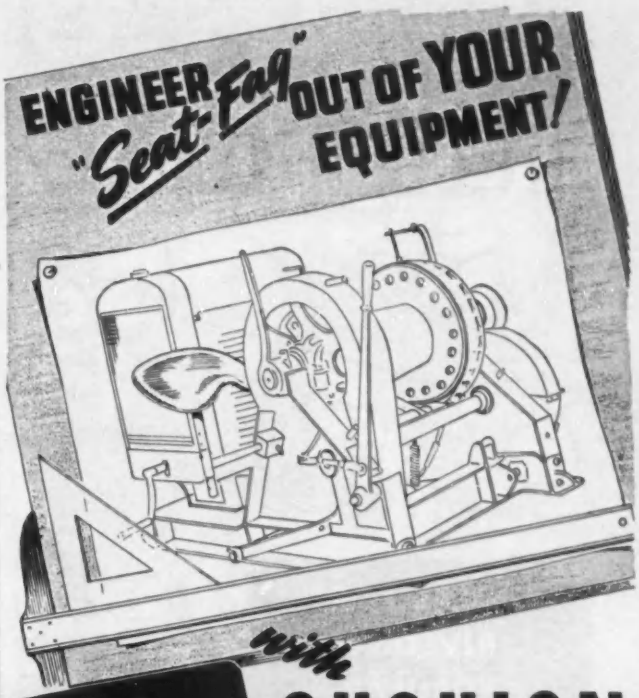
23 New and 24 Revised

SAE Aeronautical Materials Specifications

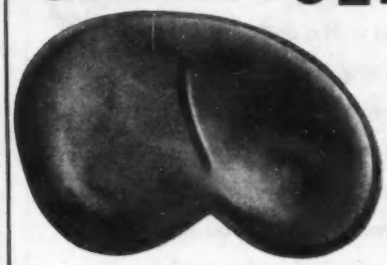
were issued November 1, 1944

For complete details please write
SAE, 29 West 39th St., New York, N. Y.



Milsco MILWAUKEE

CUSHION SEATS . . .



The No. 731 Milsco Senior Seat, illustrated at the left, is a rugged, comfortable, bucket-shaped man-size seat adapted to service on many types of equipment where economy and limited space are important considerations. Measures 17½" front to rear, 21" left to right.

"SEAT FAG" is not an empty catch-phrase but, to the contrary, carries a practical, economic significance that is of vital importance to every manufacturer and user of *riding equipment.*

SEAT FAG reduces the efficiency and productive capacity of machine operators and, in direct ratio to this work loss, reduces the productive capacity of the equipment itself.

Milsco Cushion Seats are designed to overcome Seat Fag to as great an extent as may be practical, in relation to the equipment and the work it performs. Heavily upholstered with jute felt . . . to be replaced by WHIPPED LATEX when war production restrictions are lifted . . . these seats provide a new degree of comfort for operators . . . reflected in terms of increased productive capacity.

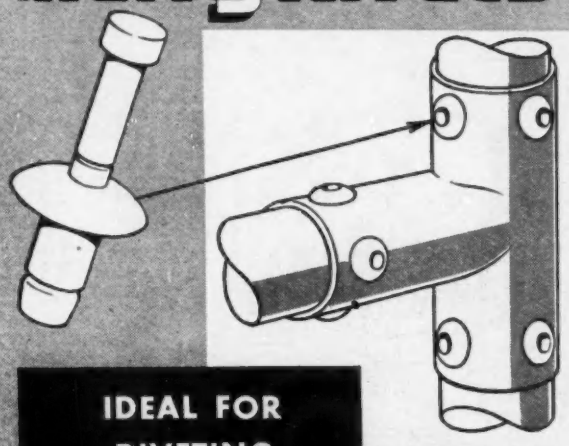
The No. 813 Milsco Junior Seat with adjustable backrest, is a typical example of a compact, easily installed, comfortable operator's seat. The seat measures 15" front to rear, 18½" left to right.

Write for your copy of Milsco Seat Cushion File "44-A" as a handy reference.

ARMY E NAVY

MILSCO MANUFACTURING CO.
2758 N. 33rd Street • Milwaukee 10, Wisconsin

CUT PRODUCTION COSTS WITH Cherry Rivets



IDEAL FOR RIVETING TUBULAR ASSEMBLIES

Don't think of Cherry Rivets only as "blind" rivets. Just remember they are upset with a *pull instead of a pound* —that they need no bucking bar—no backing up—that they turn a *two-man* job into a *one-hand* operation.

Then you will use them in all hard-to-get-at spots (in corners—wherever space is limited). You will use them in all types of metal structures; you will use them in plastics, plywoods, enameled surfaces (the pull action doesn't crack or shatter brittle surfaces)—They will work in soft materials (rubber, leather, fabric) without bending, buckling or tilting the rivet.

With Cherry Rivets, short runs become production jobs without tooling or special set-up. Remember, too, that Cherry Rivets have wide tolerance in hole size and grip length—are fast to use and most economical.

See for yourself how Cherry Rivets can cut production costs in your plant. Write for Handbook A-43. Address Department A-108, Cherry Rivet Company, 231 Winston Street, Los Angeles 13, California.

CHERRY RIVETS. THEIR MANUFACTURE AND APPLICATION ARE COVERED BY U. S. PATENTS ISSUED AND PENDING

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SAFE LANDINGS HASTEN VICTORY

On all fronts where our fighters have carried the battle to the enemy, these landing ships have performed the vitally important functions of landing men, equipment and supplies. Safe landings depend largely on secrecy and surprise, and hasten the day of Victory. . . Hallett products have helped materially to assure safe landings for these remarkable ships, often-referred to as "the most startling types of craft the war has produced"; as well as many other combat units on land and sea and in the air. And these same Hallett products, when available, will provide outstanding operating advantages for every type of engine used for civilian and industrial purposes.

Official U. S. Navy Photograph.

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Designers and Manufacturers of
Filtered Ignition Shielding for Every Type of Transport Engine
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How Oakite Methods Speed Production for Wartime Executives

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This new enlarged 44-page edition of the popular Oakite Aviation Manual covers all essential phases of production cleaning and related operations in aircraft and accessory manufacture. All the data given is based on current methods and materials used by many well-known plants.

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Added strength is gained by shot-peening with the latest conveyor-type equipment. Inspection and test of material before, during and after manufacture insure uniform quality.

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Also require two specialized technical assistants reporting to above executive—one with minimum of 8 years aircraft engineering experience, particularly on control devices; the other with 10 years marine engineering experience. In reply, submit concise but complete details in first letter, stating salary requirements, experience, etc.

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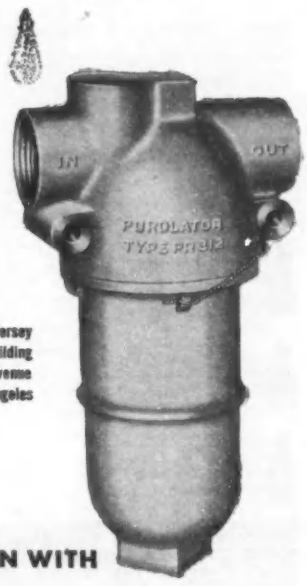

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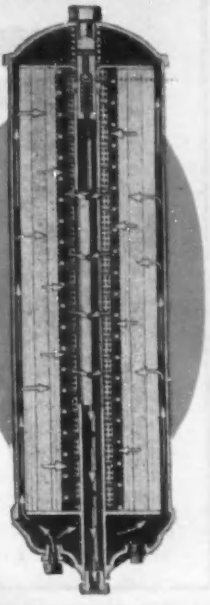

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This type Briggs Cartridge cleans oil 3 TIMES—IN 3 WAYS. First cleaning through outer layer of cellulose REMOVES solid particles. Second cleaning through Fullers Earth REMOVES acids, gums, resins that cause formation of harmful sludge. Third cleaning through inner layer of cellulose REMOVES particles smaller than 1 micron (.00004").

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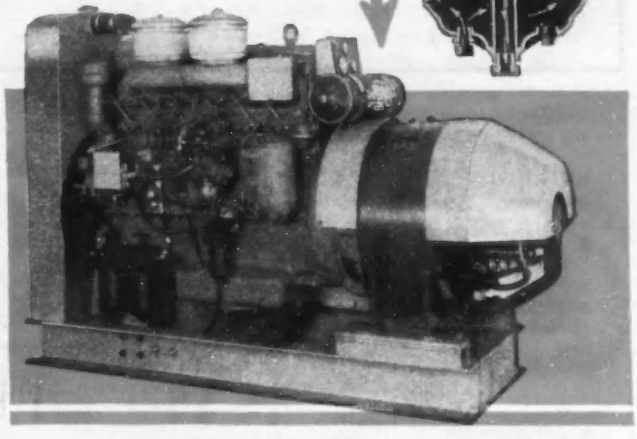

Briggs G-800 Lube Oil Clarifier installed on U. S. Motors Diesel Generator Set. Hundreds of these Briggs equipped generator sets are setting records of performance throughout the world.

Briggs Lube Oil Clarifiers on your Diesel-operated generators, pumps and compressors will save you many times their low cost and maintenance. Actual field operating reports show savings in oil consumption as much as 50%, extension of inspection and overhaul periods as much as three times. These economy features are "added attractions" to the satisfaction you feel in operating a sweet-running, highly-efficient, trouble-free engine . . . one that gives promise of a long, useful life.

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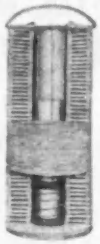

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(Above) **PRACTICAL USE OF BEETLE'S COLOR** s made in the colored covers to iden- ify contact arrangement and type of Micro Switch.

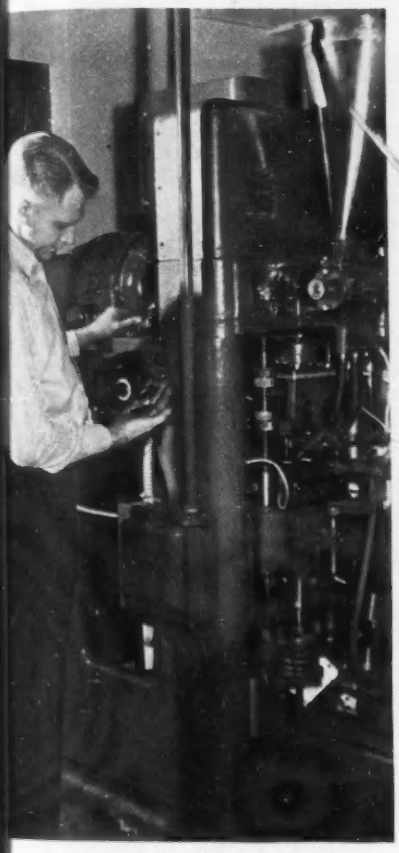
Life on the *Plastics* Newsfront

PRECISION SNAP ACTION SWITCHES UTILIZE BEETLE

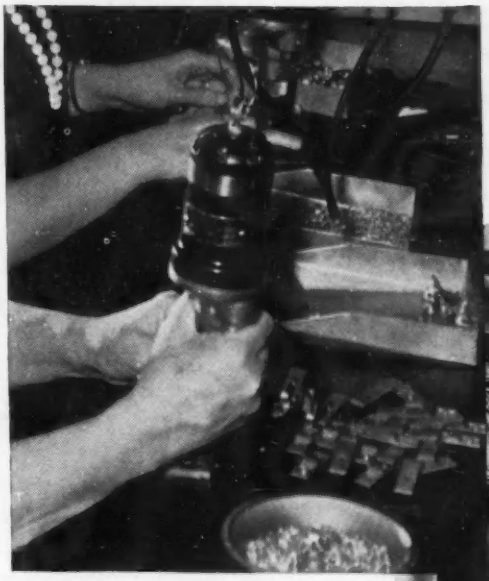
On American bombers, the bomb bay signal light, the bomb handling mechanism, the bomb release mechanism—and dozens of other vital functions from nose turret to trim tabs—are controlled by thumb-size, featherweight switches of amazing precision, product of Micro Switch Corporation.

Micro Switch housings and accessories are built to resist vibration, to function reliably when subjected to high altitudes, sub-zero temperatures, salt air, and the violent maneuvers of aerial combat. Precision molded plastic housings using Cyanamid's BEETLE* are used because of the dielectric properties, dimensional stability, light weight, and high speed production possible on this plastic material.

*Reg. U. S. Pat. Off.



(Above) **BEETLE IS MOLDED** on this Stokes Automatic Molding Press into covers for the basic Micro Switches.



(*Left*) **A THIN METAL LEAF** is attached to the BEETLE cover to provide a leaf type actuator. The screws are run through the leaf spring and into the plastic Micro Switch cover. All materials used in the switches are subjected to various chemical, temperature, and altitude tests to be sure they will function properly under all service conditions.

(*Right*) **BEETLE COVERS** are applied after the switch mechanism has been assembled in the housing. BEETLE's dimensional stability is important as there must be extremely accurate fitting of all parts. Materials and mechanism in these precision switches must retain their essential characteristics under long continuous service.

(Above) **PLASTIC-HOUSED MICRO SWITCHES** are inserted, in some instances, into larger metal housings while others are used without additional protection.

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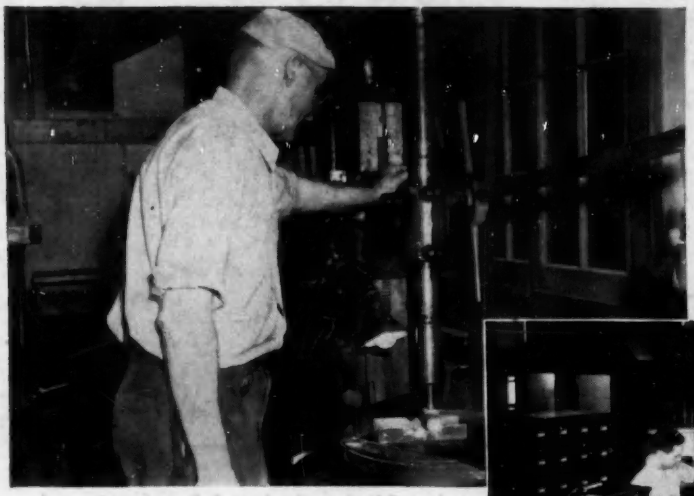

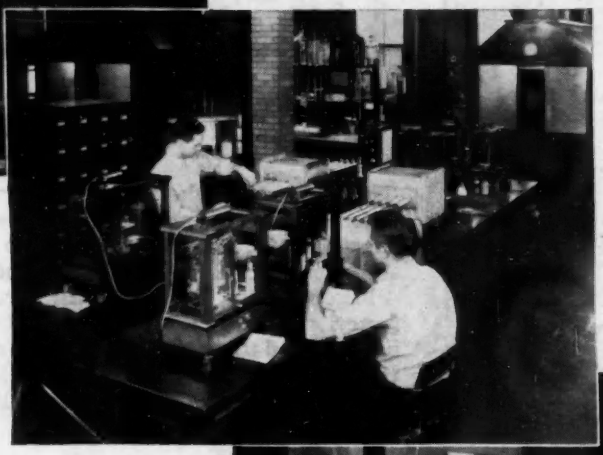

45 seconds from MELT SHOP TO LABORATORY

At regular intervals during the melting of a heat of Timken steel, small casts of the molten metal are taken for chemical analysis. Drillings from these test pieces are whisked through pneumatic tubes to the clean, quiet, modern Timken chemical laboratory which is located one-quarter of a mile away from the melt shop, free from the thundering noise and vibrations which might upset delicate instruments. Here a rapid, accurate chemical analysis is made and the results are flashed back via the telautograph to the melter who uses them to control the quality and uniformity of Timken alloy steel.

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Today Timken Alloy Steels are being used for the vital parts of Uncle Sam's great fighting machine. Tomorrow they will be ready to serve you again in a wide range of analyses to meet your individual needs. Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

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